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Forthcoming Events.

JANUARY 10.

Institute of Metals (Scottish Local Section):—Ordinary meeting, at Glasgow. Discussion on "The Value of Research." Paper by Professor J. H. Andrew, D.Sc.

JANUARY 11.

Institute of Metals (North-East Coast Local Section):—Ordinary meeting, at Newcastle-on-Tyne. "Some Aspects of the Corrosion of Metals." Paper by U. R. Evans, M.A.

Institute of Metals (Birmingham Local Section):—Ordinary meeting, at Birmingham. "Forces Set Up in Strip Rolling." Joint programme arranged by the Birmingham Metallurgical Society, the Staffordshire Iron and Steel Institute.

Institute of British Foundrymen.

JANUARY 8.

West Riding of Yorkshire Branch:—Ordinary meeting at Bradford. "Cast Iron Under the Microscope," Paper by C. R. Groves, M.Sc., A.I.C.

Lancashire Branch:—Ordinary meeting at Manchester. "The Heat Treatment and Growth of Cast Iron," Paper by J. W. Donaldson, B.Sc.

JANUARY 13.

London Branch:—Ordinary meeting in London. "A System of Costing," Paper by A. W. G. Bagshawe.

JANUARY 14.

Sheffield Branch:—Ordinary meeting at Sheffield. "A Review of the Foundry," Paper by J. Emmott.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT, 1926-27: Vincent C. Faulkner, "Thalassa," Carlton Avenue, Kenton, Middlesex.

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Middlesbrough: N. D. Ridsdale, 3, Wilson Street, Middlesbrough.

Welsh Engineers' and Founders' Association

Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

Foundry Trades Equipment & Supplies Association.

Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

Introspective, 1927.

The opening days of every new year will always find the prophets ready to forecast a boom in trade provided that there can be a period of industrial peace. This year, for obvious reasons, that thought is again uppermost, and industrial peace depends on whether leadership will be dominated by those who consider that they have something or nothing to lose. Labour conditions aside, there are other important factors which cannot be lightly dismissed. Primarily, there has been the stabilisation of the German mark and the Belgian franc, while the French franc has been partially controlled. This, to our mind, prevents a present of so much currency being given with the delivery of every casting exported from countries with inflated money values.

Though the Admiralty are again ordering but a few ships as compared with pre-war days, a real effect will be noticed in the foundries situated on the large rivers.

Whether this year will see a real improvement in the motor industry is uncertain, but in the not distant future the Dominion demand for the cheaper British cars will be considerable, as, unlike certain of their American competitors, they show up best when running on reasonably well-made roads, which are rapidly coming into being.

One of the black spots of the foundry industry during the last few years has been the lack of orders in the agricultural implement foundries. We are assured that their publicity has been poor in many respects. At the agricultural shows held

We take this opportunity of wishing our readers a Prosperous New Year.

in, say, Buenos Aires, Warsaw, Prague, Cape Town or Sydney, many of the buyers are not exceptionally erudite, or even technical, and that class is attracted by the vivid reds, blues, and yellows which adorn the American products and is left cold by the battleship grey of the British machines.

We are assured by people that matter in the textile industries that they start the year with better prospects than they have known for several years, and as, from the point of view of the number of men employed, the foundries catering for this industry are amongst the largest in Great Britain, we can look forward to improved business in this direction. The large electrical foundries start the year with good order books, the electrification schemes of the railways providing a useful quota. The foundries making castings for the mines and metallurgical industries have a good deal of arrears to make up, and they are assured of full-time work for at least the next six months.

The pipe foundries are in quite a different category from most foundries, as they expect to receive annually a fair proportion of the business placed upon the international market.

Stabilisation of foreign currencies and availability of credits are the two cardinal points, and in this respect 1927 is at least better than has been the case for many years.

The light castings industry has held its own in the markets of the world in an admirable manner, and there seems to be improved prospects for still better business. The French are becoming keen competitors in many sections, and the more mechanicalisation of British light castings industry that can be effected, so will home prospects be materially improved.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

International Foundry Chaos.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Naturally, I have read Mr. Ronceray's letter of November 24 on page 474 of the December 2 issue of THE FOUNDRY TRADE JOURNAL with considerable interest. The difficulties which Mr. Ronceray outlines are real ones, and I fully sympathise with his position.

As Mr. Ronceray points out, there are really two problems to be considered: First, to agree on the time and place of the next big International Foundrymen's Congress, in which all of the foundry interests of the whole world can co-operate as they did at Paris in 1923 and Detroit in 1926; and, second, the question of the proper sequence of exhibitions and foundry conventions in Europe.

May I suggest that we should endeavour to avoid confusing these two propositions? American foundrymen are not concerned with arrangements for holding purely inter-European exhibitions and conventions, even though they possess an international character through the participation of foundrymen representing several European countries. There is no doubt, as Mr. Ronceray says, that it is embarrassing to exhibitors to be obliged to have displays in three places at the same time. But you will note these exhibitions were all in Europe. I have no doubt that, with men like Mr. Faulkner, Mr. Ronceray, Mr. Ropsy, Dr. Geilenkirchen, Mr. Vanzetti, etc., in charge of European foundry association affairs, this purely European problem will be satisfactorily disposed of.

There is no competition between the foundry exhibition in America and those which are held in Europe, because there are only one or two exhibitors who show on both sides of the ocean.

On the other hand, American foundrymen are vitally interested in promoting the continuance of the big world-wide International Foundrymen's Congresses, such as were held at Paris and Detroit. We believe firmly that these world gatherings possess great value to the foundry industry and are equally important in promoting international understanding and accord. Therefore, we want to see them continued, and will be glad to co-operate to this end to the limit of our ability.

Obviously, however, the American Foundrymen's Association cannot undertake to organise a large special party to go to Europe to attend these conventions oftener than about every three years, with an occasional interval of six years when the world congress is staged on this side.

Inasmuch as the last International Congress was in Detroit, the next one or two must be in Europe, and you may be sure the American Foundrymen's Association will be glad to participate in 1929 or subsequently. In the meantime, we hope that the various European organisations interested in this affair, including the German Associations, may reach an agreement as to exactly when and where the next world congress should be held.—Yours, etc.,

H. COLE ESTEP,
Chairman,
Committee on International Relations,
American Foundrymen's Association.

Cleveland.
December 24, 1926.

[We are glad to assure our correspondent that the question of International Conventions is well on the way to being cleared up as a result of the recent meeting in Brussels.—EDITOR.]

Contracts Open.

Johannesburg, February 3. — Pig-iron and ferro-silicon, for the South African Railways and Harbours. The Department of Overseas Trade, 35, Old Queen Street, London, S.W.1 (Room 48). (Ref. A.X. 4037.)

Southport, January 19.—337 tons of cast-iron spigot and socket pipes, 12 in. in diameter, for the Southport, Birkdale and West Lancashire Water Board. Mr. C. B. Ede, engineer and manager, 14, Portland Street, Southport.

Institute of British Foundrymen.

Newcastle Junior Section.

The Newcastle Junior Section held a very successful Smoking Concert in the Grey Street Picture House Café, on Friday, December 10, when the members had as their principal guest their patron, Mr. H. J. Young, F.I.C., who, at the request of all present, kindly consented to act as chairman.

This is the fourth Annual Smoking Concert which the Newcastle Junior Section has held and it was greatly appreciated by the large number of members and friends who were present.

A most enjoyable musical entertainment was given by Messrs. F. W. Greenwood, J. W. Dawson, J. Cameron, L. MacDougall, C. Smith, the accompanist being Mr. W. L. Anderson. During supper, Mr. Chessard, musical director of the Grey Street Picture House, gave a selection of violin solos, accompanied by Miss Simpson.

Mr. L. B. Chapman, Chairman of the Section, said they were all very pleased to have Mr. Young with them that evening, and he would ask him to say a few words to them. MR. YOUNG, who was greeted with applause, said that—

Last year his was the unhappy task of saying, what he thought was going to be, Good-bye. Now he was fortunate in announcing that he had come back to stay. A branch of his London practice was about to open in Newcastle, and Mr. H. C. Jay—one of your members—had joined his staff to take charge of the foundry side of the new branch.

The Newcastle Junior Section was conceived in the laboratory of the North-Eastern Marine Engineering Company, and brought into being with the loyal help of Mr. Clements. When it was started, he, the speaker, insisted that the juniors themselves should conduct their own affairs. The value of junior sections is that opportunities are given to learn the difficulties of management, and to express thoughts aloud, otherwise gifts are lost to other men. Upon junior sections depend the future of our foundry industry.

All arrangements for the concert were carried out by Mr. C. R. Van-der Ben, Hon. Secretary of the Section.

Calendars, Diaries, etc., Received.

We acknowledge with sincere gratitude the receipt of the following: BRITISH PIG-IRONS, LIMITED, of Abbey House, Westminster, London, S.W.1, a monthly illustrated tear-off wall calendar; E. & W. H. HALEY, LIMITED, The New Foundry, Listerhills, Thornton Road, Bradford, a monthly wall calendar and diary containing pocket for season ticket; GRANDIDGE & MANSERGH, LIMITED, Wheathill Street, Salford, Manchester: wall calendar; BRITISH AND CONTINENTAL TRADERS, LIMITED, Astor House, Aldwych, London, W.C.2, a diary containing a large amount of specialised information of use to the foundry industry; THE STANTON IRON WORKS COMPANY, LIMITED, near Nottingham, a diary containing much useful engineering and metallurgical data; R. A. MILES (Stanton Ironworks Company, Limited), Grosvenor Chambers, Deansgate, Manchester, waistcoat pocket diary; WATSONS (METALLURGISTS), LIMITED, Lancaster Street, Sheffield, combined diary and pocket case; J. STONE & COMPANY, LIMITED, Deptford, London, S.E., waistcoat pocket diary; THE STAVELEY COAL & IRON COMPANY, LIMITED, a pocket diary; NEWTON, CHAMBERS, LIMITED, a daily tear-off wall almanack.

New Companies.

Dowding & Son, Limited, 83, Above Bar, Southampton.—Capital £5,000 in £1 shares. Engineers.

Haybridge Iron Company (1926), Limited, Haybridge Iron Works, Wellington, Salop.—Capital £5,000 in £1 shares, to acquire business lately belonging to Haybridge Iron Company, Limited, Wellington, Salop, known as Haybridge Ironworks. Directors: W. E. Shorthouse (chairman and permanent governing director), 60, Edward Street, West Bromwich; Mrs. E. Shorthouse, 60, Edward Street, West Bromwich; and Miss Kathleen W. Shorthouse, 60, Edward Street, West Bromwich.

Impressions of American Foundries.*

By S. H. Russell.

It is very difficult to generalise, having seen some very efficient foundries, and some which compare somewhat unfavourably with many English ones. Even in these, however, there were many novel and clever features, and bearing in mind the acute shortage of skilled labour, it is remarkable to see the enormous quantity and variety of castings produced.

Everywhere the British guests were received with the greatest hospitality and kindness. The author went out with the firm idea of seeing foundries working under conditions similar to those existing in his own works. He therefore hardly ever went with the big organised parties, and usually went off by himself, sometimes with a guide, sometimes without one. On every occasion the welcome was sincere, as every American foundryman seemed delighted to meet an Englishman, and was very free with his information. They afforded facilities for taking notes and sketches, and frequently invited correspondence if more information was required. Please therefore bear in mind that the author is unable to give detailed information on some of the most famous mass production foundries, as he was unable to find the time to visit them.

Concrete Floors.

If it is possible to generalise on anything in the average American foundry, it is the fact that the concrete floor is almost universal. The author visited three foundries which had a sand floor, one of which was mainly engaged on very big machine-tool castings—another, a general jobbing foundry, and the third a well planned foundry, but mainly engaged on castings weighing over 2 cwts. each, and many of them over 1 ton each. Every other foundry visited had a concrete floor, and this, of course, involves the use of bottom boards, not only under all snap-flask and taper-flask moulds, but also under every moulding box used. On the larger moulding boxes special facilities are provided for quickly securing the bottom plates to the boxes. These bottom boards are usually wood, but many cast iron and steel plates are also used, particularly on the larger boxes. Many large moulding boxes are made entirely in wood, but this practice is not common in the foundries recently equipped, nearly all the big boxes being made in cast-iron sections, bolted together, with a grid on the bottom part and loose cast-iron bars bolted in the top part.

The use of snap and taper flasks is very common, not only for machine moulding, but also for general jobbing work made over tubs or on a bench. Snap flasks are familiar to everybody, but possibly taper flasks are not so well known. As their name indicates, they are tapered and the sand is retained in the top half of the box by iron strips. After closing, these strips are mechanically withdrawn, and the flask lifted off.

This is a quicker operation than with the hinged flask, but it cannot be used if binders are to be used in the top part. Some firms rely entirely upon binders to strengthen the moulds, others use jackets of various types.

The advantages of snap or taper flasks are that the floor is readily cleared up, and the capital outlay involved is very much smaller. Also a new size of flask to suit a particular job is more quickly obtained. There are, of course, disadvantages as well, but the variety of work turned out in these flasks and the very small percentage of scrap due to their use is surprising. There is no doubt that the use of snap flasks saves much time in clearing the floors, and in all the foundries with concrete floors, a *sand cutter* is used to mix the sand for the following day. In every foundry a night gang is employed to remove the castings and shop scrap, clear the floors and leave the sand ready for the moulder in the morning. This means that the machines are producing moulds all the working day, and it is very impressive the way the men keep on working; they were all out to put as many moulds down as possible, and although many of them cast their own work, they kept on moulding every available minute.

Sand Preparation.

A whole paper could be written upon American moulding sands, but as their natural sands are so different from British, and as they vary so much in different areas, their sand preparation will only be referred in a general way. The mills or millers generally used have a very deep pan, with bottom discharge, one or two solid rollers, and two very efficient revolving ploughs. Frequently after being milled the sand falls into a power operated riddle or occasionally a disintegrator. The mill is usually elevated so that the facing or core sand falls direct into large scuttles or bins which when full are moved to their destination by a crane.

A foundry attached to an engineering firm making machine tools with a world-wide reputation has more than a local reputation for the wonderful skin on their castings. Their sand mixer is quite simple. A bucket conveyor delivers the sand into the mill, after milling it falls into a boot and is lifted by a second bucket conveyor into a revolving riddle, falling through this into a hopper. This firm use all reclaimed sand as facing on their larger work. Five per cent. of sharp sand is added to the used sand and from 4 to 5 per cent. of fine dry clay. This after passing through the above-mentioned machine is ready for use. Very occasionally new sand is added to the heaps on the foundry floors, but never direct into the facing sand.

The facing sand for the small work is a very fine smooth naturally-bonded sand, and new sand is always used. These people have adopted the standard A F A tests for their sands. The tests can be quickly taken, and give valuable comparative results. A weighed quantity of sand is taken from the heap, and is rammed into a brass cylinder by three blows from a weight falling down a spindle through a distance fixed by two solid collars. The height of the column of sand is then measured by a lever resting on the top of the spindle, and a pointer at the end of the lever indicates the height on a graduated scale. Wet sand rams closer than dry sand, and an indication is given as to the comparative moisture and permeability. The brass cylinder containing the core of sand is then transferred to another piece of apparatus, and a simple water gauge indicates the pressure necessary to drive air through the core and indicates permeability. The core of sand is then removed from the cylinder and is compressed in a machine like a small old-fashioned letter press. The core stands on a table of a spring balance and the reading in lbs. when the core collapses is taken. These three tests are made in less time than it takes to describe them, and this firm appears to regulate their sands entirely by the results of these tests. Great interest is taken in America as to their sands, and other simple methods of testing are also being developed.

As the floors of all the foundries appear to be cleared at night, the author had no opportunity of seeing the sand cutters at work. Most people complain of the high maintenance charges, but consider them essential. The tempering of the sand must call for rather skilled attention, and the author now regrets that he did not make an effort to see this work being done somewhere or other.

Sand Handling.

Here again a whole Paper could be devoted to the subject, but it is proposed to limit consideration to the simpler methods, leaving overhead conveyors, etc., severely alone. A wheelbarrow is a rarity in a foundry, but there are many different receptacles for handling sand, all of them carried around the shops by a power crane.

Most of the moulders filled their flasks by shovelling from the floor, all the sand being piled adjacent to the machine—except where the machine was on wheels and was pushed along the floor as the sand was gradually used up. Most

* A Paper read before the East Midlands Branch of the Institute of British Foundrymen, Mr. Stevenson presiding. Mr. Russell is a Vice-President of the Institute.

of the foundries visited only had one machine capable of handling boxes, say, 4 ft. 6 in. by 3 ft. by 16 or 18 in. deep, and these were frequently served by a sand elevator, lifting the sand from a bin, or, in one case, a conical-shaped pit let into the floor. Grab buckets are used for many purposes in the foundry where large work is made in pits; these grabs dig the holes out, and also floor sand is transferred about the shop if necessary. The most novel use seen for one of these tools was in emptying a pit over which all large castings were cleaned. The pit was covered with a removable grating, and the sand fell through, leaving the metal flashes, gaggers, etc., on the grating. There is no doubt that this tool is very useful for many purposes in a foundry doing large work.

Core-making.

Oil sand is very extensively, though not universally used. It was surprising to find that very many cores are still made by hand, far more than was expected, but the sand-blowing machine seen at work both at the Exhibition and in one or two foundries will undoubtedly be used for all small repetition cores very soon. In principle sand is forced by compressed air into metal core boxes. These core boxes have to be carefully designed, and, if at all intricate, have small air vents drilled in all corners and pockets. The speed at which they work is remarkable; the output depends entirely on the organisation and handling, as the actual blowing operation is almost instantaneous. One malleable ironfounder is saving in wages $22½ per day—*i.e.*, over £4 10s.—by using one machine.

All sorts of machines are used for core-making, many of them very similar to those in use here. Light hand-jolt rollover machines are made by one firm especially for core-making. It was interesting to notice in one works that the cores were rammed on an ordinary jolt table, and that if the "draw" was difficult, the core box, after being rammed, was transferred to a simple machine for lifting off the core box. Sand trays are extensively used, and special attention is given to the supply of suitable flat plates for the plain cores. Pneumatic rammers are being extensively used for finishing off jolt-rammed cores.

The core shops are usually carefully designed, warm and light. The core stoves are nearly always modern, fired in various ways, and are usually supplied by firms specialising in their manufacture. It was interesting to note the efforts one firm made to avoid the jointing of cores. One large body core was made in three sections, each section was designed to be rammed through a large open, flat face, and the three pieces were assembled on two lengths of 3-in. gas pipe located and rammed in the centre core. Round cores had a loose panel in the top half of the box. The core was rammed up through the opening, and the panel bedded in. Loose pieces which have to be withdrawn from under the core are reproduced in iron, and left in position until the core is dry.

The resulting cores are truer to shape and size than cores made in two sections, and jointed afterwards, but the risk of misplacing or forgetting loose pieces bedded into the top does rather limit this method.

There are very few women or girl core-makers, perhaps because in many States the Factory Act regulations are very stringent, but these vary in different States, and it is quite possible that women labour is utilised in some districts.

Many foundries use the overhead runway system for distributing the molten metal. The ladles are often only about 3 or 4 cwt. capacity, and, as the cupolas are 48 and 54-in. diameter, it is necessary to have some sort of reservoir into which the molten iron can be stored whilst the full ladle is moved on, and the empty one pushed into position. Some works use a dipping spout—that is, a deep spout on swivels, with a large basin at the back end. This is inclined towards the ladle until full, then tipped backwards, and before the basin at the back is full the next ladle is in position, so that, if the cupola is melting sufficiently rapidly, and there are sufficient ladles, there is no necessity to "bott up." Other firms use a mixing ladle, with a spout projecting about half-way up the ladle. This is tilted forwards to fill the ladle, and then returned to the vertical position.

One works visited had an overhead system bearing a well-known English name. This consisted of a telpher track carrying a ton ladle, controlled by the operator seated in the cab, and supplying small ladles suspended on hand-operated cranes, running at right angles to the track.

Another firm used battery trucks, each carrying three 2-cwt. ladles on the platform. These were filled from the mixing ladle, and distributed to hand-operated cranes.

A rather unusual layout serving a medium-sized jolt moulding machine may be of interest, because it consists essentially of two overhead swivelling cranes on parallel tracks, the hook of each, when the arm is swung across the bay, covering the centre of the floor. Electric power is used for hoisting and travelling, the swinging movement being operated by hand. All controls were operated from the ground. The advantages claimed for this system over an ordinary overhead crane were that one crane can be used for removing rammed boxes and for coreing up, whilst the other crane carries up the empty boxes.

A Jobbing Shop Layout.

A typical layout of a foundry producing castings, say, 10 cwts. to 3 tons, a few only being required usually from each pattern, consists of two parallel bays, one bay being the moulding shop, with three large jolt machines at one end. The moulds, after jolting, are transferred to the centre of the shop, where a separate gang draw the patterns, finish the moulds, and place them in a drying oven. A third gang receive these moulds when dry at the other end of the shop, core them up, close and cast them. The second bay contains the shake out, the fettling shop, and the moulding-box store. The cupolas are placed at the end of the shop at which the pouring is done.

A Small Mass-Production Brass and Aluminium Foundry Layout.

This foundry was located on the sixth floor of a concrete building, the machine shops, stores and offices being on the floors below. The moulding machines are arranged along one wall, with sand bins directly over them, delivering reconditioned sand from a conveyor. The machine operator places the rammed mould on a bench behind him, where a second man cores it up. Single-sided pattern plates are the rule here, the moulds being used alternatively as bottoms and tops. Running parallel with the line of machines are two conveyors travelling in opposite directions. The nearer one is the shake-out conveyor, with grates over it at intervals. The other is the hot-castings conveyor. At right-angles to these two conveyors, and crossing over them, are a series of roll conveyors, which serve as pouring racks. After the mould is closed it is placed on the end of a roll conveyor. The moulds slide very easily along these conveyors, and the operator pushes them along in front of him until the rack is full, when he starts to fill the next rack. Casting is almost continuous, and within a few minutes a full rack of moulds is cast, a shake-out gang return the moulds to the shake-out conveyor, the hot castings are dropped into their conveyor, and the empty boxes stacked near the moulding machine. Each moulding machine was producing 385 to 400 complete moulds, each part about 20 in. × 12 in. × 4 in. deep, per day.

The Detroit Exhibition.

This was described in America as the greatest show in history; probably every one they have is thus described, but it was certainly the largest and most complete exhibition of foundry plant and accessories the British visitors had ever seen. It was held in the State Fair Grounds. These are a large group of permanent buildings built in a large and well-laid-out park, with wide roads and a tramway siding adjacent to the main building. The reception rooms, registration office, and information bureau were housed in a two-storey building, the upper floor being used for the technical meetings and sessions.

Machinery in work was shown in the Coliseum and in the Dairy Barn, two large and imposing buildings, and in the Agricultural Hall were sands, oils, and binders, with many details of

equipment and accessories. There are a remarkable variety of types of moulding machines. Nothing radically new was noted, but those familiar to Europe have been improved in many details, and most of the machines exhibited were robust, free from complications, and with all mechanical controls very accessible. Hand-ramming is obviously not popular, nearly every machine has some form of power ram, though quite a number of them in the smaller sizes have no mechanical pattern drawing arrangement. One firm, in addition to exhibiting a complete range of machines, nearly all of them working, had a pair of machines working on a miniature mass-production system. A sand elevator lifted the sand into a reconditioning machine, then into bins over the machines. A hand-controlled gate in the bottom of the bin measured the correct amount of sand required to fill the box. The bottom-parts were rammed on a jolt rollover squeeze machine, and were conveyed along a gravity roller conveyor to an automatic conveyor. As they passed the second machine, the top parts were placed on the bottoms, and when the complete boxes had travelled round the system, and were presumed to be cast, they were pushed on to the shake-out by an automatically operated ram, the sand falling into the boot at the foot of the elevator, and the box being lifted off by hand, was returned by an overhead conveyor to the moulding machines. These boxes measured 22 in. × 14 in. × 9 in., and were easily produced at the rate of one per minute by the operators. Another exhibitor had several machines working on very big jobs, one making railway truck wheels, and a larger one making lengths of grating—two in a box. These were jolt squeeze machines with roller conveyors for both rammed moulds and empty boxes. These people were using cast-steel boxes, and had the squeeze heads specially shaped to fit inside the bars of the boxes. The Sandslinger exhibit was also very complete and efficient.

All types of conveyors, hoists, cranes and trucks were shown at work or by working models. The ground conveyor for moulds appears more popular than the overhead type, probably because they do not shut off the light, are more accessible, and have a neater appearance.

The lift or elevator is such an institution in America, owing to the many-storeyed buildings, that there are many types offered suitable for foundry work. There was a very complete range of equipment shown for sand-handling, and also an electrical machine for moisture testing and recording. Many firms showed shake-out equipment. This is usually a modification of a jolt-ram machine, but one exhibit was a range of giant vibrators with a simple attachment for use on jobbing work. Two exhibits of sand-mixing and blending machines attracted a large and interested crowd whenever they were operating. One of these is now marketed by a British firm, the sand is very efficiently blended and aerated, and as it leaves the machine is projected 12 or 14 ft. away. The other was of German make, and was demonstrated mixing the sand and throwing it up a chute into a sand bin 40 ft. above ground level.

There was also a complete working exhibit of the Holley permanent moulds, the iron being melted in an electric furnace. Amongst the many other working exhibits were air compressors, five large machines being required to keep the exhibits running. There were several types of sand-blast equipment, including one large installation entirely loaded and unloaded by mechanical means, all sorts of core ovens, including one electrically heated, pneumatic small tools, such as chisels—which are very extensively used in fettling grey iron—grinders, riddles, rammers and hoists.

There are a number of firms in England offering liquid or dry sand binders, but eighteen different firms had exhibits at the Detroit Exhibition.

Last, but not least, the Exhibition had its own newspaper, an eight-page, well-printed paper, fully illustrated, the whole of its pages being devoted to reports of the meetings of the American Foundrymen's Association, photographs, and brief accounts of the authors of various papers, and of the officials of the Association. A good deal of the space was devoted to photographs, details of, and interviews with, the various foreign delegations.

In conclusion, Mr. Russell urged upon all foundrymen the necessity of an eternal discontent with their present methods, no matter how good they think they really are. Americans believe in a high-wage policy given a good production, and they aim at a maximum of quality with a maximum of quantity.

Everything possible is done to save human effort and labour, even in the jobbing foundries, so that a moulder or a machine operator is producing all the time. The type of labour available for foundry work is nothing like so good or so settled as ours. Most of the men operating the machines are aliens, *i.e.*, Slavs, Italians, etc., with a good proportion of coloured Americans. These men appear to move about and change their occupations a good deal, so that the management are forced to introduce mechanical methods whenever possible to balance the lack of skill of their employees. It is not surprising to note that many of the men occupying responsible positions are Scotchmen, and were delighted to meet their fellow-countrymen in the British Delegation.

DISCUSSION.

MR. STEVENSON expressed his interest in the machine which travelled along over the sand heap, but it had always been a moot point in his mind as to which was the more paying proposition—to take the machine to the sand and boxes, or the sand and boxes to the machine; he had always been doubtful, too, as to whether it paid to put work in snap-flasks rather than moulding boxes. He had noted that most of the American foundries had concrete floors, and supposed that for bedding-in jobs pits were used.

MR. RUSSELL said that he had not seen any bedding-in jobs, as very little, if any, loose-pattern work was done, and further, some of the foundries were on the first floors of buildings, and obviously it would be impossible to make bedding-in pits in them. He would imagine that they would make a box or frame, and so form a soft bed.

MR. LUCAS referred to the question of concrete floors, and the author's reference to the use of bottom boards, and he wondered if these were necessary. Could the author give any idea of why it was necessary to use bottom boards? He was aware the Americans were supposed to be authorities on moulding-machine work, and in mounting patterns on plates for use on moulding machines. Was it necessary to introduce an amount of core-making to make the moulding easy? It seemed to him that the machine for blowing sand into the cores could only deal with very plain cores, and had the author seen the machine handling intricate cores, such as required boxes with, say, three or more joints. He was rather impressed with the jobbing foundry practice of making the moulds on a machine where only two or three castings were required off the one pattern. Was it the practice in the States to mount every pattern on boards for moulding machines; if so, it apparently involved very expensive patternmaking.

The underhung swinging jib crane seen by the lecturer during his tour in the States presented interest, as only a few yards away from the lecture room in which they were seated there was a photograph of an installation of electrically-operated underhung swinging jib cranes of British manufacture, and he was particularly glad to note Mr. Russell's remark that even into the American foundries, crane installations of British manufacture had found their way.

In reply, MR. RUSSELL, referring to bottom boards, said it would be noticed from the illustrations shown that every casting had a bottom board or plate. He did not agree with the suggestion that the core-blowing machine could not make a complicated core, as many of the illustrations showed that some of the cores were very complicated. In the Middle West the supply of skilled moulders was so scarce that the founders faced the expense, and mounted every pattern on a board, but not necessarily on its

own board, as he had seen several ingenious adaptations where one board served for several patterns.

MR. PEACE noticed Mr. Russell made no mention of the quality of the work turned out. He (Mr. Peace) had seen a good number of American castings in this country, and it would be interesting to know if the class of castings over there was no better than that sent over to this country.

MR. RUSSELL agreed that on the whole the American castings were not so good as the British.

MR. EVANS said he noticed the author had laid stress on the fact that he had only visited jobbing foundries, and if the jobbing foundries were so far advanced, it made him wonder what the production foundries were like. The author had said that one man put down 385 to 400 complete moulds per day off one machine, and having in mind the lack of skill of the labour involved, it made him wonder what the scrap percentage reached. No doubt a tremendous output was obtained, but no mention was made of the proportion of scrap. Apparently the Americans made a great feature of reconditioning sand, but from the author's description of some of the sand-conveying methods, the sand must travel a considerable distance, and in his (Mr. Evans) opinion, it must then be much too dry to be used; as a matter of fact, from personal experience, he knew that sand under such conditions, at least in this country, must be retempered. Referring to taper flasks, Mr. Evans said his experience had been that on the joints great care must be taken not to get the strips too wide, as when the strips were taken out a weak place resulted, out of which the metal would run. He had had one of the core-blowing machines in use, and his experience had been that the boxes must be finished to half-a-thousandth. Plain cores could be made on the machine, but up to now it was no improvement on the present methods of making cores. It was, he thought, necessary to use boards or plates where snap-flasks were used on squeezer machines.

MR. RUSSELL repeated that he had not seen any of the American mass-production foundries. There was no doubt that the American foundries did have a high waster percentage, but they were not alone in this respect. He noted with interest Mr. Evans' own experience with regard to the drying of sand on conveyors, but there was no doubt that the Americans had solved the problem.

Vote of Thanks.

A vote of thanks having been accorded to him, MR. RUSSELL said he held himself at the disposal of any member of the audience to amplify any point they were particularly interested in, and he could not let the opportunity pass of paying a tribute to the wonderful lantern, and to Mr. Driver for his manipulation of it, which enabled ordinary snapshots, such as he had shown that evening, to be thrown on to the screen.

Science, Research and Industry.

Capt. F. A. Freeth, O.B.E., D.Sc., Ph.D., F.R.S. (Head of the Research Department of Brunner, Mond & Company), deputising for Sir Alfred Mond at the City Hall, Cardiff, at the annual prize distribution of the Technical College, delivered an instructive address on "Science, Research and Industry," in the course of which he said science could be defined as systematised knowledge and was largely of modern growth. It was true that there was a logical continuity in mathematics but the science of chemistry, to which they owed so much was of modern origin. The benefits which science in general had conferred upon their civilisation had been immense, and altogether outweighed anything that could be urged against it. It had been said that the standard of comfort of the average working man in this country to-day was greater than that enjoyed by fourteenth-century noblemen. The actual span of life had been greatly increased.

It had, however, been said that science was directing its results to rendering war more destructive and more horrible. It was true that it added a new terror in the late war, but they should not forget that nature herself was sometimes more deadly than any human agency of destruction. The influenza epidemic which followed the war was responsible for more casualties than occurred amongst all the combatants. It was not too much to say that the future of civilisation would depend entirely upon science.

Fixation of Nitrogen.

The great corporation by whom he was employed had just completed one of the most brilliant achievements of this generation. At Billingham, in Durham, they had erected a huge plant for extracting nitrogen from the air, which was essential for food supplies, and which could, if the dreadful necessity arose, maintain them in war. Science had constantly given instances of work, which had apparently little to do with anything in this world or the next, proving of enormous value and commercial importance.

Leaving the question of science for a moment, the speaker said that within a few months many of the students would be in their first jobs, and would meet the older generation possibly kindly and possibly hostile. In this regard he would implore them not to fall into the error of supposing that because a man could not solve a quadratic equation as quickly as himself that he was no good at his job. They would find often that the older man was conscious of his lack of nominal training, but, handled with tact, and with that deference which the young should show towards the old, they would find that they had a great deal to learn from the older generation.

Always remember, he added, that one of the biggest mistakes a student can make is reasoning on insufficient premises, and that there is often an additional factor one can learn from the man on the spot.

Research.

Turning to research, he said that it was the active working factory for the production of the results and data of science. There was, of course, the theoretical and practical side of research, and as time went on they would tend more and more towards what might be called the paper side of science. If they knew everything and all the laws governing the behaviour of matter, they would never need to do any experimental work, but could conduct any new operation right away by merely drawing on the stores of existing knowledge. They were, however, a long way from this ideal, but in the meantime they would not be far wrong in agreeing with Lord Kelvin that "the foundation of all progress lies in its exact measurement."

Chemistry only began to be a science a hundred years ago, since that time it had indicated one of the greatest advances of mankind, and its results had had the greatest significance to civilisation. The key to this previously closed door had been the development of numerical relations. It was said that there was nothing new under the sun. The idea of exact measurement was certainly old if one considered how long chemistry had had to wait for its application. Plato more than 2,000 years ago put the following words into the mouth of Socrates: "If the art of measurement, weighing, and the theory of numbers are applied to a science, how little remains over for any other method." History showed that every principle existing at present in chemical science had resulted from the careful and precise investigation in the field of physics. This was not surprising when one remembered that of the human senses, only two, taste and smell, were purely chemical in character. All the other senses depended for their action on physical energy.

Concluding with a few remarks on industry, the speaker said that the progress of industry depended, in the first instance, for its raw materials, as it were, entirely upon the results of science. The other great and essential factors, character, energy, honesty and foresight, were not, and had never been, lacking in these islands. Much had been said about industrial peace and he ventured to think that science could contribute to this.

A New Melting Installation.

We recently had an opportunity of inspecting a newly installed melting plant at the Edmonton, London, works of Messrs. R. & A. Main, Limited. It is of interest to note that this plant is the third supplied by the same manufacturers, Messrs. George Green & Company, of Keighley. It was about twenty years ago when they were first called upon to supply a 2-ton an hour plant. The present is a twin installation, capable of melting singly 10 tons an hour. They

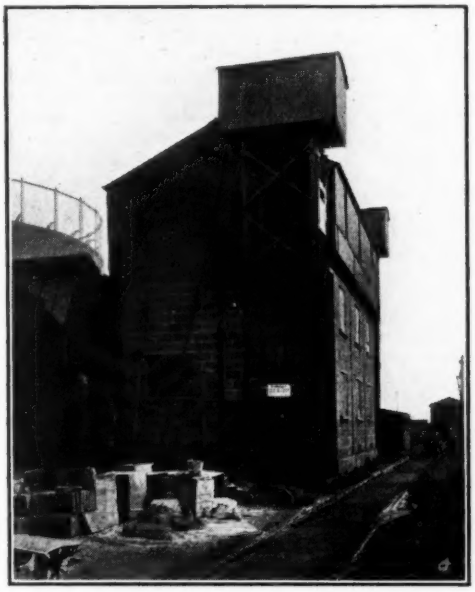

FIG. 1.—THE CUPOLA SHED, MESSRS. R. & A. MAIN, LIMITED.

are 6 ft. diameter cupolas, with drop bottoms. The charging platform, of very ample dimensions, is served by two hoists. These have a 12-cwt. capacity, and are electrically operated. The charging floor has been walled on three sides by concrete blocks, as is shown in Fig. 1. The blast is supplied by a pair of electrically-driven direct-

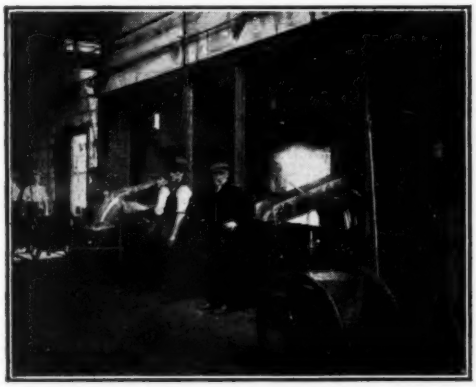

FIG. 2.—THE TAPPING SIDE OF THE CUPOLA PLANT, MESSRS. R. & A. MAIN, LIMITED.

coupled Keith-Blackman fans, erected in a blower house, arranged below the charging floor. The speed of the fans is admirably controlled by a Vauxhall pillar. The blast pipes are so arranged that either fan will blow either cupola, or both fans can run together when both the cupolas are running.

Fig. 2 shows one of the cupolas tapping out. It will be noted the metal is taken away in large wheeled ladles fitted with ball and roller bearings, also supplied by Messrs. Green. Before teeming, it is shanked into bull ladles. This is the favourite system for foundries of the type of Messrs. R. & A. Main—that is, manufacturers of light castings. In this case the major production goes into the manufacture of gas stoves. Though this foundry is situated in London, the conduct of the foundry approximates closely to that followed in the Falkirk foundries. Most of the patterns are mounted on plates, and are hand moulded. The production attained, however, is remarkable, and constitutes a hard row for the moulding machine manufacturers to hoe.

To return to the melting plant, which was the object of our visit, we regret that we were unable to take any fuel consumption figures, as, owing to the coal dispute, the melting practice was not normal. The stack is lined with firebricks, finished by the designers, and is giving good service.

Pearlitic Structure of Cast Iron.

At the December meeting of the Wales and Monmouth Branch of the Institute of British Foundrymen, held at Cardiff Technical College, Mr. J. G. Pearce, Director of the British Cast-Iron Research Association, gave a talk on the pearlitic structure in cast iron, illustrated by a number of lantern slides and samples. He pointed out that if ordinary pure iron, such as electrolytic iron, or a reasonably pure commercial iron, such as wrought iron, were examined under the microscope, the grains of metal would be readily seen, the grain boundaries being clearly marked at the junctions of the light-coloured grains. The addition of a small amount of carbon resulted in the darkening of some of the grains, and the darkening increased as the amount of carbon added was increased, until at nearly 1 per cent. of carbon the whole area would be changed. It might be thought that the change was due to the iron forming iron-carbide with the carbon, but examination of the dark grains at a high power showed that they were not wholly iron-carbide, but had a striated or laminated appearance, plates of iron being interleaved with plates of iron-carbide. The double structure was that commonly termed "pearlitic," and this usually contained about 0.9 per cent. carbon. Beyond this percentage more carbide of iron formed than could be accommodated in the laminated structure, and large white plates of brittle iron-carbide appeared.

Proceeding to consider the case of cast iron, it was pointed out that carbon not present as carbide would be there as graphite, and consequently it was desirable, in order to minimise the graphite, not only to have a low total carbon, but to have as much of the carbon combined as was consistent with a strong machineable iron. This fixed the combined carbon at about that required to form pearlite. In the majority of ordinary English castings the amount of silicon and the rate of cooling used resulted in an ultimate combined carbon of about 0.4 to 0.5 per cent.

The lecturer then illustrated the constituents manganese-sulphide and the phosphide compound and showed the general undesirability of these structures, the ideal cast iron consisting wholly of pearlite and graphite. Common cast iron contained not only quantities of manganese-sulphide and phosphide, pearlite and graphite, but also iron, due to slow cooling and break up of the carbide into its constituents. Each of these substances had its own particular specific gravity, thermal expansion and conductivity, specific heat, etc. It was therefore easy to understand the internal stresses set up in heating ordinary cast iron. Pearlite, on the other hand, had to be treated as a single substance, and therefore all pearlitic iron was much more homogeneous in its properties than common cast iron.

The lecturer then compared the structures of hot-mould iron, Emmel iron, permanent-mould irons and low-carbon irons, and showed the influence of chilling at the mould face in a cold mould. He also referred to the Corsalli process for cupola melting, recently developed in Germany. Differences in size and distribution of graphite due to these different methods were indicated, and the mechanical properties given.

An interesting discussion followed, to which Messrs. Jenkins, Kinsman, Hird, Galletly, McClelland, Fontaine and G. D. Jones contributed.

XUM

The International Foundrymen's Convention at Detroit.

(*Continued from page* 534, *vol.* 34.)

BY OUR SPECIAL CORRESPONDENT.

Parting with extreme reluctance from our venerable and interesting friend, we partook of iced ginger ale from one of the semi-portable fountains in the Exhibition Hall, and again concentrated our attention on the exhibits. THE BERKSHIRE MANUFACTURING COMPANY, Cleveland, O., showed us more and still more moulding machines—jolt squeezers, stripping platers, and last, but not least, an excellent plain squeeze pattern draw machine known as model "E." Mr. Henriques was as full of affable information as his two colleagues, and we judged this firm fortunate in their representation and the sound usefulness of their machines. Becoming by now expert critics of the "points" of moulding machines, we were not disappointed by Mr. W. H. Nicholls, of the WM. H. NICHOLLS COMPANY, of Brooklyn, N.Y., who showed us his own, and gave us the benefit of his ideas. His sand-handling equipment took our eyes, and very nearly some of our money, being hard to beat for handiness and efficiency.

The day was hot, and the building, oh, so dry! But not drier than us! So we got a little tired of being shown things, and started out *incog.* to find them for ourselves. The first we found was the exhibit of the C. O. BARTLETT & SNOW COMPANY, of Cleveland, Ohio. Advancing in a threatening manner, we inquired brusquely what this complicated mechanism was supposed to be doing. We found we had fallen into the hands of a Mr. First, and we finished a bad second, for when he had ceased explaining to us that the monster before us was a continuous sand blender and mixer, and had paused for breath, we could only weakly admit that this was certainly the biggest and most serious attempt at solving a difficult problem that we had yet seen. The machine is large and powerful, and is admittedly successful as a mixer, though our recollection is that it does not profess to be also a miller.

The various varieties of sand are deposited on a conveyor belt from bins, thence passing into a drum, and afterwards through rolls fitted in a novel manner with scrapers. The sand comes out at the bottom in a continuous stream, nicely mixed and ready for use. All day and every day it can, or does, keep on keeping on, so long as there is sand in the bins, and it is obviously cheap to operate. We liked it, and should have liked it better if space had permitted the whole extent of the process to have been demonstrated.

YOUNG BROTHERS COMPANY, Detroit, next door, was a sort of Aladdin's Cave, which turned out to be a "Mold Oven" (see small bills!) or drying stove, size 20 ft. × 20 ft. × 8 ft. It was very comfortably furnished, and would have made a nice week-end cottage. The tables and chairs were quite good in their way, as was the core oven also shown. We were considerably intrigued by the photos and films of various installations of mould and core-drying plant, and bore away with us much literature which we can commend to the notice of any founder interested in this somewhat dry, "mouldy," and "cores" subject. This stand is manned by a band of eight "young"-sters, of which Mr. G. A. Young is the chief. We wish him the best of luck.

Learned as is your scribe in divers questionable and unquestionable lores, and at home as he may be in devious industrial bypaths, he has yet to acquire the rudiments of the art and science of that spectacular oxy-acetylene welding and cutting which has a fascination for so many of us that there was a crowd round the show next door, which was that of the OXWELD-ACETYLENE COMPANY, of New York, etc. He found himself delivered into the hands of as gentle a band of "burning" enthusiasts as ever convinced an amateur of their absolute mastery of their subject, and held him, despite a Saharan thirst and the gnawing pains of hunger, till not an exhibit was left unexplained. There were Mr. Thum, Mr. Boggs, and Messrs. Griffith and Wissler. We liked them all, and we will tell you what they told us and showed us, or what we thought they told us or showed us.

First of all, they set themselves to harden certain parts only of malleable iron castings and to leave the adjoining parts soft. This they did by melting on to the surface of the casting an alloy called "stellite." No doubt every reader has known all about this for years, but there were certainly four men near your correspondent to whom the idea was a new one. Undoubtedly it is successful, for the devilish little flame melts the alloy like sealing wax, and little skill is needed to coat a surface evenly This our friends called "spot hardening" and its usefulness is obvious.

"Stellite," we learnt, "was a hard abrasive alloy metal, which will work at a red heat, and on a really heavy cut will work almost up to a white heat." We saw it doing it, and were duly impressed, whilst not venturing to suggest that the high speed steel of Sheffield (Eng.) would conceivably be of service in the cutting of stellite into pieces of a suitable size for the market.

However, the real darling of the hearts of our friends was the dinky special blowpipe—an instrument that will weld cast iron. With recollections of having a broken iron casting sent back from the welders with the intimation that the job was impossible because "they couldn't weld cast iron," we made a mental note of the point and were told that the acetylene gas was under low pressure in one duct whilst the oxygen was under high compression in another. Consequently—when they met—the latter "injects" the former along with it, whilst a third duct in the pipe feeds neat oxygen to the flame and oxidises the cut! The difficulty in cutting cast iron is due, we gathered, to its carbon being in a refractory graphitic form. Free carbon is added to the "cut" so advanced that the flame has carbon to burn. This produces a heat so intense that the graphite itself becomes burnt, and the cutting of the cast iron is rendered possible!

With heads bursting with information, and strength failing rapidly, our devoted band of Britons tottered to the stand of THE NIAGARA CONCRETE MIXER CO., of Buffalo, and saw a new type of rocking vibrating screen with a "trembling" effect, the like of which they had never seen before. Though but little over a yard in length and lying at an angle of at least 30 deg. it was absolutely impossible to persuade any sand to remain on it for even half a second, even if the sand were plumped on it almost at the foot of the slope (the delivery end). There was never, never anything on that screen at all—a screen half the size would have done twice the work, and it is a positive fact that a glove thrown on to the delivery end, actually travelled uphill! A good, in fact, a remarkable screen, on which we congratulated the Messrs. Wettlaufer and bade them farewell.

THE MILWAUKEE FOUNDRY EQUIPMENT CO., Milwaukee, were near enough to attract our wandering glances on the way to the canteen. It was another maze of amazing volt squeezers, strippers and moulding machines galore. By this time our unacclimatised party were so enfeebled that they were only just able to stand this one more stand, and to cast a rapid but exacting eye over its serried arrays of labour-saving devices. "A fast and accurate drawer" said a dulcet voice of a volt roll-over drawer machine. 'Twas true, but pausing only for a glance at a new hand ram centre roll-over machine which undoubtedly fills a want for low deep work, we fled.

The Osborn Exhibit at Detroit.

The Osborn continuous moulding unit operated at the Detroit Convention produced moulds at the rate of one every 56½ seconds, or 63.7 moulds every hour. Truscon steel flasks 13¾in. by 21½ in., with 9-in. drag and 4½-in. cope, were used. The pattern was lent by the Westinghouse Electric and Manufacturing Company, of Cleveland, Ohio. The system required three men to operate, in addition to the pouring.

By variable-speed motor control, the speed of the power-driven mould conveyor can be decreased or increased to suit conditions. The production of 510 moulds in an 8-hr. day could be doubled by adding a second pair of machines and increasing the speed of the conveyor.

Making the Drag Half.

The moulder making the drag half of the mould on the No. 322 Osborn jolt roll-over squeeze pattern draw moulding machine takes his flask from the return flask conveyor at the rear of the moulding position, places it over the pattern, and fills the flask with sand from the overhead bin by an air-operated measuring gate which discharges into the flask the proper amount of sand required to fill it. The measuring gate is adjustable to accommodate different sizes of flasks.

The mould is jolt rammed, and struck off approximately ¾ in. above the top of flask by strike-off device, which is a part of the machine. The bottom board is placed and clamped in position, and the mould is then rolled over. The squeeze piston is raised to contact with the bottom board, squeezing the mould to the proper density, and automatically bedding the bottom board. The clamps are released and the mould drawn down and away from the pattern. In the squeeze table are mounted a number of rollers which raise up in the last ½ in. of downward pattern draw movement, lifting the mould from the squeeze table and supporting it on the rollers. A roller table, extending from the squeeze table to the power-driven mould conveyor, lines up with the rollers in the squeeze table. The operator pushes the finished drag mould from under the machine out on the roller table and against spring-cushioned stops.

Placing Drag on Power-Driven Mould Conveyor.

As the mould conveyor plates move forward into line with the roller table, a cam attached to the front of the plates operates an air-controlled transfer mechanism, which transfers the moulds automatically from the roller table to the mould conveyor plates.

Making the Cope Half.

As the drag moulds are moving forward in line with the cope moulding position, the cope moulder makes copes on the No. 175 Osborn jolt squeeze stripper moulding machine, and closes the moulds on the conveyor. The operation is as follows:—

The operator takes the cope flask from the return flask conveyor, places it on the pattern, and fills with sand from the overhead sand bin. It is jolt rammed, squeezed, and on the down stroke of the squeeze piston the pattern is automatically drawn from the mould.

Closing the Moulds.

In the meantime a finished drag mould has moved forward on the power-driven mould conveyor in line with the cope moulding position. The cope moulder lifts the cope half from the machine and places it over the drag, loose pins being used for closing.

THE OSBORN STAND AT THE DETROIT EXHIBITION.

Shaking Out and Returning Flasks.

The completed moulds pass around to the pouring position, and continue around to the shake-out position, where they are transferred from the power-driven mould conveyor plates to the shake-out machine by a mould pusher operated by air, the bottom boards remaining on the power-driven mould conveyor plates. A few jolts remove the sand from the flask. The empty flasks are then placed on the return flask conveyor by the shake-out operator.

Sand Handling.

The sand passing through the shake-out machine discharges into the boot of the vertical elevator, which elevates and discharges it into the rotating sand screen. The usuable sand passes through the screen on to the delivering bolt, which transfers it to the sand bins located over the moulding machines. Lumps of sand or foreign matter caught by the riddle discharge out at the end of a tote box.

The system is handled in Great Britain by Messrs. J. W. Jackman & Company, Limited, of London and Manchester.

Economy and Production.*

On reading through some articles on the Problem of Production, we were particularly interested in one on the "Economy of Human Effort." The profession of the engineer has been well defined in the charter of the Institute of Civil Engineers, but another and almost essential part of his duty is to save work and by this means save all unnecessary fatigue. This can be done by making the work easier to perform or by substituting mechanical power for human effort. Nearly every industry has made some attempt, and the majority great attempts, towards mechanicalisation.

However, there still, and always will, remain numbers of operations and minor tasks that require to be performed by human effort. The appliances used for these are often rudimentary in form, and mostly have been copied from some ancient model which, in performing its service, set a fashion that arrested natural evolution. The apprentice learns his trade with the tools of his master and so becomes accustomed to the weight and form of each, and any change afterwards is not welcomed owing to time and patience necessary to accustom him to the change. At South Kensington Museum the tools used by James Watt are preserved, and it will be noticed that the simple ordinary tools, files, centre-bits, chisels, bradawls and gimlets, etc., have not altered appreciably in the last 100 years. It can be argued that this is not due to conservatism or fashion, but that the tools in question have been evolved to a degree of perfection that has made attempts at improvement unremunerative. In several cases, however, this can be shown to be not the case.

The chisel cut file is easily beaten by the milling cut file in the removal of weight of material in the same time, and for the same effort. The auger-bit of American make produces a better job and a cleaner cut hole than the centre-bit, with less effort, and stonemasons have before now admitted that they would rather use the long-handled, well-balanced engineer's hammer than the short-handled, long-headed hammer, to which they are tied by the custom of their trade. The American axe, by merit of balance, is superseding the clumsier British form. The fact that these changes come from outside favour the theory that conservatism checks improvements in hand-tools. A special case of this is in the design of their handles. The ordinary saw or plane handle is better suited to a man whose hand is about ¼in. less wide than the present normal hand. It is a fact that it is very difficult to find a man small enough to fit the suits of armour that are preserved to-day, but although modern clothes are not made to the dimensions of the old armour, the dimensions of tool handles are unchanged. Many a pattern-maker working at a trade that requires the production of accurate work by means of a trying plane removes the maker's handle and replaces it with a comfortable handle of his own design. The American went a step further and made the plane with an adjusting screw for the iron, to save knocking the plane about, and to give a positive adjustment of the cut. It is generally found that with the American type tool the work is produced with less effort, or better work with the same effort.

There is a story of two judges, one of whom sought comfort, to the horror of his tailor, by insisting on being measured for his trousers while seated, because, as he stated, he passed most of his day sitting down; and the other who had a thick coating of putty spread on his chair, and after seating himself and working it to a shape he found to be comfortable, had a chair carved to the same form as his pattern. Revolutionary as these methods appeared to the tradesmen concerned, they reveal an appreciation of the necessity for research, and for adopting accessories for the greater comfort of the user at work. The wheel of the itinerant knife grinder's barrow generally affords evidence of this copying instinct carried to its extreme limit by the copying of an erroneous and useless idea in the curved crank-arm, the form of which is supposed by some to cure the trouble of "stopping on the dead centre," and by others to "gain leverage."

If the conservatism of the operative is bad, that of the employer is in many cases worse. Old machines are kept at work and are expected to turn out good work long after they have passed what should be the limit of their life. The man who can get good work out of a bad machine can also get good work out of a good machine, and his time rate would be very much better and the power expended probably less. For production it is essential that the work should be turned out, not only correct to size, but in reasonable time, and that time must vary little from the best time obtainable commercially if the employer is to keep his business and the operator and the machine are to keep their jobs. It must be recognised that machines and men must be taken together, and that it is more necessary than ever that the power-driven machine, fed and controlled by human agency, should make the smallest demand possible on the operator for muscular effort, attention and alertness. The modern machine is or should be limited to keeping it supplied and allowing it to do its work. The conditions must be such that the operator has to waste no time in thinking and scheming, and that the jobs go through with the greatest certainty and punctuality possible.

It seems necessary, therefore, that some attention is required with regard to the education of the individual worker to details of this description, and also, for that matter, of the employer. At the present time sufficient attention and consideration is not given to the conservatism of human energy, and any further advancement or progress along these lines can only come about by a closer co-operation between employer and employee. Also by considerably greater initiative on the part of the latter. As mentioned previously, there are many cases of pattern-makers substituting more useful handles on planes, etc., and is it too much to suggest that workers in other trades and branches of engineering should use their thoughts and ideas to a greater extent with the same object in view?

As far as education is concerned, one lesson that has stood out conspicuously in connection with both the National Strike and the coal stoppage was that our educational system, built up over many years at heavy cost, had not enlightened the great mass of the working classes on the necessity of applying economic principles to industrial and commercial problems. The strikers failed to exercise independent thought and judgment. Permanent prosperity can never be reached unless politics are banished from industrial problems and the paid agitator relegated to his proper place. We should all seek to preserve the individual freedom, rights and privileges of both employers and employed free from Government interference, which in commerce is calculated to check enterprise, expansion and progress. A greater spirit of co-operation should exist between the employees themselves, the employers, and of the one to the other. A spirit of understanding, trust and knowledge is the only one that makes progressive co-operation possible.

* From "The Staveley Company's Magazine."

Personal.

MR. R. G. BLAKE, J.P., of Castle Hill, Bakewell, has been elected a director of Kayser, Ellison & Company, Limited.

MR. H. LEWIN, who has been connected with East India Light Castings Company, Limited, has severed his connection with that concern and has returned to his home at Prospect Road, Old Whittington, Chesterfield.

MR. G. E. BAILEY, works manager to the Metropolitan Vickers Electrical Company, Limited, Trafford Park, has been elected president of the Manchester District Engineering Trades Employers' Association for the second year.

Wills.

MERRETT, W., of Lamberts', Limited, hydraulic engineers	£9,572
WATSON, W. H., of Danehill, Sussex, late of Hornchurch, retired engineer	£14,115
KEAY, J. A., of Kinghorne Road, Dundee, of Beath & Keay, engineers and iron-founders	£11,461

The American Steel Foundry Industry.

By R. A. Bull, Chicago.

(*Continued from page 572.*)

Adaptation of Plant to Product.

The war period and the following reconstruction days taught industry many useful things. The steel foundry operator probably learned more in the five years ending in 1922 than he had ever learned before regarding the kinds of work that could be produced economically in his shop. His information along this line has been increased materially during the past four years by the careful assembly and broad distribution of data relating to costs. The problem of determining, at a reasonable expense and with desirable promptness, the actual cost of miscellaneous steel castings is one beyond the ability of the specialty-shop operator to appreciate. The jobbing steel foundry has the disadvantage of a labour cost that is higher ordinarily than all other items of expense. Certain operations cover an enormously wide cost range. Prominent among these is the comprehensive treatment described generally as cleaning, in which the ratio between lowest and highest costs in a steel foundry making miscellaneous castings may be as one to twenty, without any corresponding difference in the production expense of any other department.

Without doubt, ignorance regarding classified and job costs is responsible for many serious handicaps imposed on themselves, by steel foundrymen in seeking work. Many who in recent years have studied carefully this phase of the business agree that the industry now is in a healthier condition than ever before, because of the growing realisation by steel foundry owners that specific job costs present the only basis for the intelligent search for new business. Such costs are by no means easy to obtain. Ingeniously-devised systems must be carefully tried out for an extended period before they can be regarded as satisfactory for prolonged universal application.

The analysis of job costs has resulted in important changes in manufacturing and merchandising policies in many plants. The conviction grows that the success of the industry as a whole will be dependent largely on the degree to which it becomes further specialised. This term is a rather difficult one for some to apply to jobbing shops. There, however, it is found that many factors other than weight limits can be established, making it feasible to eliminate work poorly suited to existing facilities, and to increase the volume of castings whose manufacture is well adapted to equipment and training characteristic of the locality.

Probably one of the most important developments in future specialisation in the steel foundry industry, because of the amount of work affected, will be the exclusive manufacture in plants having melting units of small capacity, of castings well within the desirable weight limits for shops where special facilities are provided for small and medium-sized work; and the refusal of the larger open-hearth foundries to complicate their operations by the manufacture of castings under those weight and section limits that necessitate extra supervision at the expense of regular work, and temporary expedients because of the lack of special equipment.

Inevitably, as steel foundries are able to install satisfactory systems correctly allocating the many items collectively known as overhead expense, manufacturers of the product will find themselves specialising, sometimes perhaps without fully realising it, through intensive merchandising efforts to secure work for which specially trained personnel and carefully selected equipment are available. Probably the exasperating complexity of steel casting manufacture has been magnified by the immaturity of the industry, and the resulting lack of specialised effort.

Eventually, all makers and users of the product will know how to classify the steel foundryman who claims to make satisfactorily for the discriminating consumer and profitably for himself, any kind of steel casting in a plant whose principal items of equipment for the major operations are not diversified and separately grouped.

Competitive Materials.

The nature of competition that may be expected affords a topic for discussion in an attempt to gauge future conditions in the industry. The problem of competition has differing aspects for the several branches of the industry and for producers in each branch, according to the nature of the work being executed in individual plants.

Without attempting to make specific references to parts or devices now being produced in cast steel, forged steel, or malleable iron, some important principles underlying the economic selection of each of these materials may advantageously be considered. The three metals just enumerated are referred to, because steel foundrymen generally will concede that their present and prospective efforts to maintain or extend the use of their product bear a closer relationship to the developed or expected adaptation of forged steel and malleable iron than to other materials.

No honest, well-informed steel foundryman will deny that properly made steel is slightly improved by skilful hot-working, if the design of the piece is such as to prevent strains from being set up in members to be subjected to service-stresses out of proportion to the resistance of the over-strained sections. No forging expert should deny that a steel object may be seriously injured by forging at improper temperatures or by peculiarities of design that cause excessive strain in locations not adaptable to the forging operation at temperatures within a working range that is suitable, practically and technically. Properly made steel forgings of certain designs are undoubtedly superior to steel castings, in some physical properties, assuming for the metal in each case equally skilful melting and pouring. It is appropriate to refer to the fact that, necessarily, steel for castings generally is delivered from the furnace in a more thoroughly degasified condition than is steel poured in ingots to be subsequently forged; and through that operation to have any gas cavities flattened and apparently eliminated, often not visibly affecting the soundness of the forged article, but actually establishing a potential cause for failure.

These comments are made with no desire to criticise the qualities of the average steel forging, or to deny the economic employment of forgings as compared with castings for certain purposes. The number of pieces required from a single design and the comparative costs of pattern and die equipment are factors of prime importance in choosing the product of the foundry or forging shop, in most cases. But there are other considerations such as have been suggested above which should be kept in mind by the user. He who employs either a casting or a forging should not delude himself by the impression that the properties ascertained from a tensile test piece are necessarily indicative of those in each member of any finished steel part, especially one of complicated design.

Fortunately, in the competition between steel foundrymen and malleable iron foundrymen, unjustified claims regarding average properties of either product are being eliminated. There ought to be and doubtless will be in the near future, a mutually appreciative and fairly competitive spirit actuating both classes of producer. Probably this condition will depend on recognition of the properties of the stronger material on the part of manufacturers of the weaker material, and admission on the part of the makers of the stronger material, that it is economical to employ the weaker one where the severity of known service conditions does not overtax the resistance of the product, and where consequently the weaker material, being cheaper, should be selected. The terms strength and weakness are here employed in a general sense, embracing toughness.

Comparisons are odious in metallurgy only when they are unfair in origin, interpretation, or acceptance. The final success of any manufacturing establishment will depend in no small degree on its honesty in promulgating informa-

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tion regarding its own product, and in meeting claims made for rival products. Neither of the two industries that can be reasonably considered as occasional competitors of the steel foundry industry can be attacked advantageously by efforts to sell steel castings where forgings or malleable castings should be employed. The forger and the malleable founder will not gain lasting benefits from efforts to introduce their products where, from an economic standpoint, steel castings should be applied.

Looking forward and judging from developments of the last decade as well as from reasonable prospects, it would appear that the steel foundryman has every reason to be optimistic regarding the competition of the future, in so far as it may relatively affect his merchandising efforts to maintain and further to advance the extensive use of steel castings.

Specifications for Steel Castings.

Mention has been made of the requirements customarily prescribed in the beginning of the present century when ductility values far below those demanded to-day were acceptable to ordinary consumers of steel castings. There was a very wholesome effect on the industry produced by the zealous systematic study of the behaviour of steel castings under shocks and stresses of exacting kinds, undertaken about 1900. Such analysis of performance was stimulated greatly by war needs embracing in many cases conservation of weight and maximum toughness or resistance to wear under heavy demands. Discovery of the highly important relationship of heat-treatment to the above-mentioned and other characteristics of performance had much to do with the stimulation of steel foundrymen in improving methods for annealing, normalising, and heat-treating according to special procedures, the products of their plants.

Almost simultaneously with the development of information on the influence of heat on the physical properties of steel came the beginnings of systematic investigations of alloy steels for castings for a fairly wide variety of uses. Probably the handicap to the steel-casting industry of over-expansion during a few years, was more than offset by the stimulated development of scientific heat-treatments and the origination of those combinations of the elements which place the product in the category termed alloy steels.

Unfortunately, some years ago there developed the tendency of certain consumers to include chemical limits other than those for phosphorus and sulphur, while prescribing minimum physical properties. It is regrettable that this movement gained followers to an extent that has handicapped steel foundrymen who have been placed under unreasonable restrictions occasionally by lack of technical knowledge displayed by some consuming interests. Certain individuals advocate rejection limits for carbon, manganese, or silicon, one or more, in a product required to have minimum values for physical properties, but which would not be influenced harmfully by wide deviations from chemical limits proposed. Engineers preparing specifications should not lose sight of the fact, of enormous significance in metallurgy, that the percentage of any element cannot be scientifically considered except with relation to the prevailing percentages of many, if not all, of the other elements in the steel. This renders ineffective the helpful intention undoubtedly actuating those who, for example, would, if they could, limit the steel casting producer to a maximum manganese content of 0.85 per cent. The proper proportion of manganese or silicon, or each of certain other elements, is what is needed according to the existing combination of the elements in the metal, considered with respect to the anticipated service of the product.

Imposing comprehensive chemical limitations causes the purchaser to assume a portion of the responsibility that should be placed alone on the manufacturer. An additional handicap is the discouraging effect on steel makers, some of whom would probably have shown more zeal than they have exhibited in the intentional production of steel of unusual chemical composition for experimental purposes, if there had not been manifested by certain consumers a conviction that they should reject metal containing percentages of the elements differing from those narrowly prescribed.

An instance of misguided effort made by some responsible consumers to prescribe how steel shall be made, may be mentioned. The writer was confronted a few years ago by a specification dated March 28, 1917, prepared by the engineers of a well-known company making boiler plant equipment. The specification was for important steel valve castings. The blue print showing the castings called for acid open-hearth steel, annealed, to have a silicon content of from 2.00 to 2.50 per cent., a sulphur content of 0.08 per cent., a phosphorus content of 0.40 per cent., a manganese content of 0.60 per cent., and a carbon content of 3.25 per cent. Physical tests were required for the material specified. It is unnecessary to elaborate on the negotiations that resulted in the delivery of a suitable product. It bore no resemblance chemically to the material specified by the engineers.

Fortunately, for the benefit of the producers and consumers of high-grade steel castings, it is gradually becoming apparent to those clothed with the responsibility of preparing specifications for steel castings, that ambiguous language should be excluded: that recommendations as to foundry practice have no proper place in instruments like specifications, the clauses of which should be of mandatory character: that indefinite conditions regarding heat-treatment should be succeeded by positively worded provisions instead of such phrases as: "The castings shall be properly annealed!" that there are a great many details of foundry practice not mentioned even by suggestion in many commercial specifications which are of the greatest importance in the production of sound steel castings, some of which deserve consideration as reasonable to cover in a positive manner, affording desirable protection to the buyer and appropriate latitude to the seller; that it is, in brief, equitable and scientific to use specifications for steel castings which place no undivided responsibility for careful manufacture on the foundryman through the imposing of unwarranted chemical limitations, but which will prescribe so far as is practicable, those details conceded to be safeguards in making a product, the characteristics of which cannot be completely gauged by the customary physical tests, by chemical analysis, by microscopic examination, or by all of these means combined. The writer believes that during the next decade there will develop a significant movement in the direction indicated, which will result to the distinct advantage of high-grade producers and those whom they supply.

A few comments seem advisable regarding limitations for sulphur and phosphorus. The Joint Committee on the Investigation of the Effects of Phosphorus and Sulphur in Steel has been conducting a comprehensive research into the effect of sulphur for approximately seven years, and has published, through the agency of the American Society for Testing Materials, several preliminary reports. The last of these, presented at the June, 1926, Convention of the Testing Society, was the first expression of a conclusion reached by the joint committee. In the past, engineers have not agreed as to the desirable upper limit. The more liberally minded have established the dead line at 0.06 per cent., while the ultra-conservative contingent has looked askance at a sulphur content exceeding 0.04 per cent. It is not surprising that previously, in the absence of authoritative information as the result of a sufficient number of comparable tests, judicious engineers have followed the policy of playing safe. The published results of thousands of tests covering the extraordinarily comprehensive investigation by a large representative committee which conducted its research by disregarding all theories previously held, afford a scientific basis for universal agreement that a sulphur content of 0.06 per cent. does not reduce the serviceability of steel castings.

Future Technical Investigations.

There are many operations that have been under investigation, which have yielded a great deal of value and will continue to place at the steel founder's disposal, data on which to base improved practices. Some subjects have been studied in a haphazard manner, occasionally by individuals who were at a disadvantage because they had

routine operating responsibilities. In the search for an ideal facing sand, possibly all steel foundrymen at some time have committed the error of observing the apparent results of the facing without proper regard for the contaminating influences on the castings, of unclean and improper gating, and unskilful pouring. Many steel foundrymen have reached the conclusion that there are numerous grades of sands that are probably well suited to their product, if they are skilfully bonded and handled. Probably the average steel foundry of the future will devote much more attention than it does now to the careful proportioning of the ingredients, to their thorough blending, to the regulated percentage of moisture, and to the suitable handling and storage of the prepared sand in ways that will prevent deterioration and subsequent unskilful treatment by the moulder. Means will probably be provided in many steel foundries for daily gauging refractory properties to prevent deterioration of the heap sand. Sand control methods have made their entry into progressive steel foundries in a manner that assures the permanency and future expansion of the policy.

Degasification of Steel.

The degasification of steel, which is a more correct term than deoxidation, frequently employed as indicative of the identical condition, presents a problem of baffling nature even to those steel foundrymen who have personnel and equipment for conducting intensive studies embracing practical and theoretical details, both necessary for the proper consideration of this subject. Reference has been made in the earlier portion of this paper to the importance for the industry of the development of green-sand moulding, within our memory. A feature of this kind of moulding, relating in an important way to the reasonably thorough degasification of steel, is the influence on it of the high percentage of moisture in green sand as compared with the proportion in an oven-dried mould.

There are highly-qualified metallurgists associated with companies skilfully producing certain alloys, the chief function of which is to cleanse the steel by the liberation of gases. Unfortunately some of these gentlemen, through lack of familiarity with commercial steel foundry conditions, make deductions and give assurances regarding the useful substitution for aluminium, of alloys that prove to be disappointing in the two-fold effort to maintain in the metal the original degree of ductility, and to put the steel in such a condition when poured in a green-sand mould containing ordinarily from 4 to 5 per cent. moisture, that there will not exist in the interior or on the surface of the resulting castings, the slightest evidence of porosity, commonly termed "pin-holes." Pouring steel into moulds containing a fair percentage of moisture, and pouring it into cast-iron ingot moulds are two very different things, particularly when we keep in mind the mechanical processes to which the ingot is later subjected, changing in a radical manner the characteristics of the pockets originally containing gas.

Universal Panaceas Non-existent.

Without doubt there is opportunity for the prolongation of carefully-planned investigations to develop a material that will serve the double purpose. It may be that the complete elimination of aluminium in the steel foundry is an objective that will never be reached. A few writers on steel foundry topics have occasionally referred to shop practices in a way indicating that they do not employ this element because of its bad influence on physical properties. Technical exploiters of deoxidisers have expressed themselves along similar lines. Painstaking efforts to obtain evidence from the manufacturers of deoxidisers and degasifiers disclose nothing completely satisfactory, when the standard employed for determining the results is a green-sand mould of a design that, despite liberal provision for mechanical venting, has, by experience, been found occasionally somewhat peculiarly suscentible to a few pin-holes. Practical steel foundrymen know that such susceptible casting designs exist, and that successful manufacture in such cases is attended by intelligently regulated aluminium additions.

In the final analysis, the interests of steel foundrymen, of their very helpful associates who produce degasifying alloys, and of consumers who need steel castings of the highest grade, will not be served by attempts to cloud the issue that presents for the future a problem justifying a great deal of research. Among other things, the progressive steel foundryman has learned that it pays to be frank, and that exaggerated claims and deceptive gestures are not profitable eventually.

Much has been done within the last 10 years to ascertain the potential physical properties in steel castings by the application of varied forms of heat-treatment. There has been considerable impetus given our own industry in this respect through the concentration of attention on the subject by users of an enormous variety of steel products other than those made in the foundry. The rapid growth of the American Society for Steel Treating is sufficient evidence of the present aggressive disposition to develop heat treatments best suited to the peculiarities of the product. Researches in the steel foundry for many years will be conducted into the subject of heat-treatment, and will, of course, include consideration of the different types of ovens, including those lately developed which employ electric current. Some of these obviously permit a more thorough distribution of heat than can be arranged for in a fuel-fired furnace.

Among the operations that have provided channels for investigation are those related to gating and heading—one deserving the continuous attention of investigators. Many of these will learn more than they now know regarding the principles that ought to be observed in permitting entry of the metal, and ample but not excessive opportunity to supply the voids created during solidification. This problem is one of particularly local significance. It is made complex in the jobbing shop, where broad experience and marked ingenuity can be regarded as indispensable for economical practice, frequently aided by experimental work.

The composition control of steel is a factor in the satisfactory nature of the foundry's product which is deserving of research in many plants. The close approach to the locally-desired proportion of each of the five commonly-determined elements in steel, even when followed by properly applied heat-treatment, by no means provides invariably the means for obtaining superior physical properties. The steel may be very inferior, yet come within close chemical limits prescribed. The result of the annealing or normalising treatment may be all that could be expected, yet the performance of the physical test specimens may show undesirable material. However, the satisfactory uniformity and agreement with established values of physical tests cannot be expected unless there is a very fair degree of uniformity in chemical composition. For this reason and because of the fact that never can steel melting be positively and completely controlled, there is opportunity for useful research in the future, to closely approach the ideal of undeviating chemical composition.

A New Cupola Development.

Messrs. G. F. R. Giesler, of 58c, Gray's Inn Road, announce that they have acquired the British rights for the Poumay Cupola transformation system. It will be known as the Giesler-Poumay system in this country. It has been excellently received in many Belgian and French foundries including such well-known names as Cockerill et Cie, Esperance-Longdoz; and Pont à Mousson. Its progress in Great Britain will be watched with great interest.

German Locomotives for South Africa.—The South African Railways have placed an order for fifty-four locomotives with the German firms of Krupps in Essen, and Hanomag in Hanover. Tenders were invited from Great Britain and Germany for the engines, but the South African Railways, finding that the German quotation was considerably below the British, placed their order in Germany.

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The Jolt Ramming Process Discussed.

At a meeting of the West Riding of Yorkshire Branch, Mr. A. L. Key, of Stockport, delivered his lecture on "Some Further Experience with Jolt Ramming." The address had been delivered in similar form to other Branches of the Institute, and previously been published in the Journal. By means of a series of lantern slides he illustrated his various remarks, and his methods as to the use of baseboards and the applications of cores, etc., called forth unstinted compliments. He said he did not for one moment wish his listeners to think that perfection in jolt ramming had been reached, rather was this branch of their industry more or less in its infancy, but nevertheless, rightly utilised, it would prove a great advantage in the saving of time, production costs, and particularly in regard to a better standard of work. To attain this, however, it would be necessary in the beginning of one's experiments to give a large amount of study and hard work, but if intelligently followed up, the results would prove all he could state in favour of the method. It must always be remembered that local conditions, physical energy, and the adaptability of the workman were factors which varied in different areas of the country. In advocating the use of plates in order to avoid "flaking," Mr. Key also pointed out that scientific jolting produced an even density. Sand was packed much more evenly than by the old method of hand ramming, whilst the jolt-rammed moulds were self-ventilated. The castings were consequently better in quality and appearance, and, speaking generally, no priming was needed. It was also noticeable that the castings were far less liable to blowholes from jolt-rammed moulds as against the hand-rammed boxes. A further advantage was that by a little judicious planning a large number of boxes could be accommodated on one type of machine. From the humane point of view, the saving of that most fatiguing use of power in hand ramming was equal almost to 100 per cent., and it was possible to perform with the machine in about one minute as much ramming as it would take the average man a full hour to perform. Before coming to any decision as to the type of machine to install, it was necessary to give very careful consideration to the type of work required to be done. The position in which it should be placed should only be decided upon after considering every detail in the foundry itself. It should, however, always be within easy distance of sand, tools, boxes, etc., otherwise much valuable time would be wasted in transporting these essentials or the boxes themselves to the machine. One should always aim for the maximum rigidity and the minimum of vibration; the latter was the cause of much faulty and spoilt work. Again, whilst semi-skilled labour might answer very well for some purposes, the best and most economical work was always obtained if properly skilled workmen were engaged.

Question of Transport.

MR. W. G. THORNTON, of Bradford, in opening the discussion, said his jolting experiences were limited, but he had found that 24-in. square boxes of 6-in. deep bottom and 4-in. deep tops were not suitable for a certain type of machine he had in mind, and after many months' experimenting he had gone back to the hand-plate moulder as being the best method for his special type of casting. He also insisted that for maximum benefit from jolt ramming it was necessary to have the sand and machine in close proximity, otherwise the loss in time which was taken up in carrying more than wiped out any advantage which might otherwise be gained. He had doubts as to the saving made by machines when the cost of installation of plant, repairs, capital outlay, etc., were all taken into account. As to the limits of a jamming machine, he had found that this was the weight which the machine could lift; it was lifting capacity alone which fixed the limit of any job which could be undertaken.

MR. KEY, in reply, said there was really no delay in regard to transport if proper precautions were taken in the first instance. It was simply a matter for intelligent use of the crane, boxes being removed backwards and forwards as the demands of the machine needed, always bearing in mind that to get the maximum benefits the machine once started should be kept going until all ramming was completed. As regards men, all the workmen under Mr. Key's supervision had been trained at their own works, and whilst they were experts on the jolting machines at their own foundry, he did not suppose that they were nearly so experienced in plate moulding as those of Mr. Thornton's works. As regards the saving of 50 per cent. which he had mentioned, taking all into account, as regards depreciation, repairs, etc., after the cost of installation had been met under capital outlay, he would say that in the case of the large machine he had shown in his illustrations, it had only needed two very small repairs during the six years it had been in use. He had moved it once, but that was because he had found it would be more useful in its present position than the original one. This machine only cost 1s. 4d. per working hour to run, and a job which would cost, say, £12 10s. under the old methods, would only cost £2 10s. on the machine. The latter figure was presuming that the machine was kept working at its full capacity for the working day. For intermittent working, of course, the cost of machine jobs would be proportionately higher. He did not altogether agree that the limit of any machine was the weight problem only, but rather that the possibilities for scientific application of the number of jolts required for each particular job should be fully appreciated. Jobs weighing up to 50 tons had been put on the machines, but the limit again was dependent on air pressure. The latter in his own case was obtained from the ordinary power for their works, and only worked out at about one-fifth of a penny for a machine per hour.

MR. G. E. BOOTH, of Bradford, raised the question of flaking. Boards had been made at his works similar to those illustrated, but when these boards were removed lumps were continually falling off, in the case of the top boxes especially. These were from the green sand with "gaggers" in. They had tried varying the number of jolts for each job, but more jolts resulted in worse results. Tapered boxes had been tried, but in the end they had to hand-pack the top boxes. Mr. Key stated that in the case of large jobs these could be done with green sand in tapered boxes, but he had found that by introducing tapered bars in the boxes better results had been obtained, as these bars added to the ease for packing the sand tighter. He had also found that by the means he had indicated for the stopping of back spring or vibration when jolting, much of the trouble in regard to lumps falling off was obviated.

Sand Preparation.

MR. PARKER (the Branch-President) stated that in order to reduce this "back spring" he had found that plates made half as thick again as usual, together with due attention being paid to the rigid tying down of the plates before beginning to jolt, had given good results. He had also found it an advantage to keep a man specially watching the cotters. His experience was that good work was very largely dependent on stability, with which Mr. Key agreed. Turning to the question of the smaller foundries, Mr. Parker asked whether in the opinion of the speaker it was an economic proposition to put in a jolting machine. Could Mr. Key give them any information regarding the hand jolters or electric machines which had been advertised for such shops where the introduction of machines of the type illustrated in the lecture was not possible?

With regard to the loose pieces which the speaker had mentioned, would he tell them whether they rammed under these sections before or after jolting? (Mr. Key interposed a remark that this all depended on the depth of the boxes.) He would also like to hear something about sand preparation for jolting. He had found many times that the moisture had a tendency to come to the top,

and it was sometimes very difficult to get any even distribution of moisture. Jolting had a tendency to take the moist sand to the surface, and resulted in "scabbing." Had Mr. Key found this to be the case?

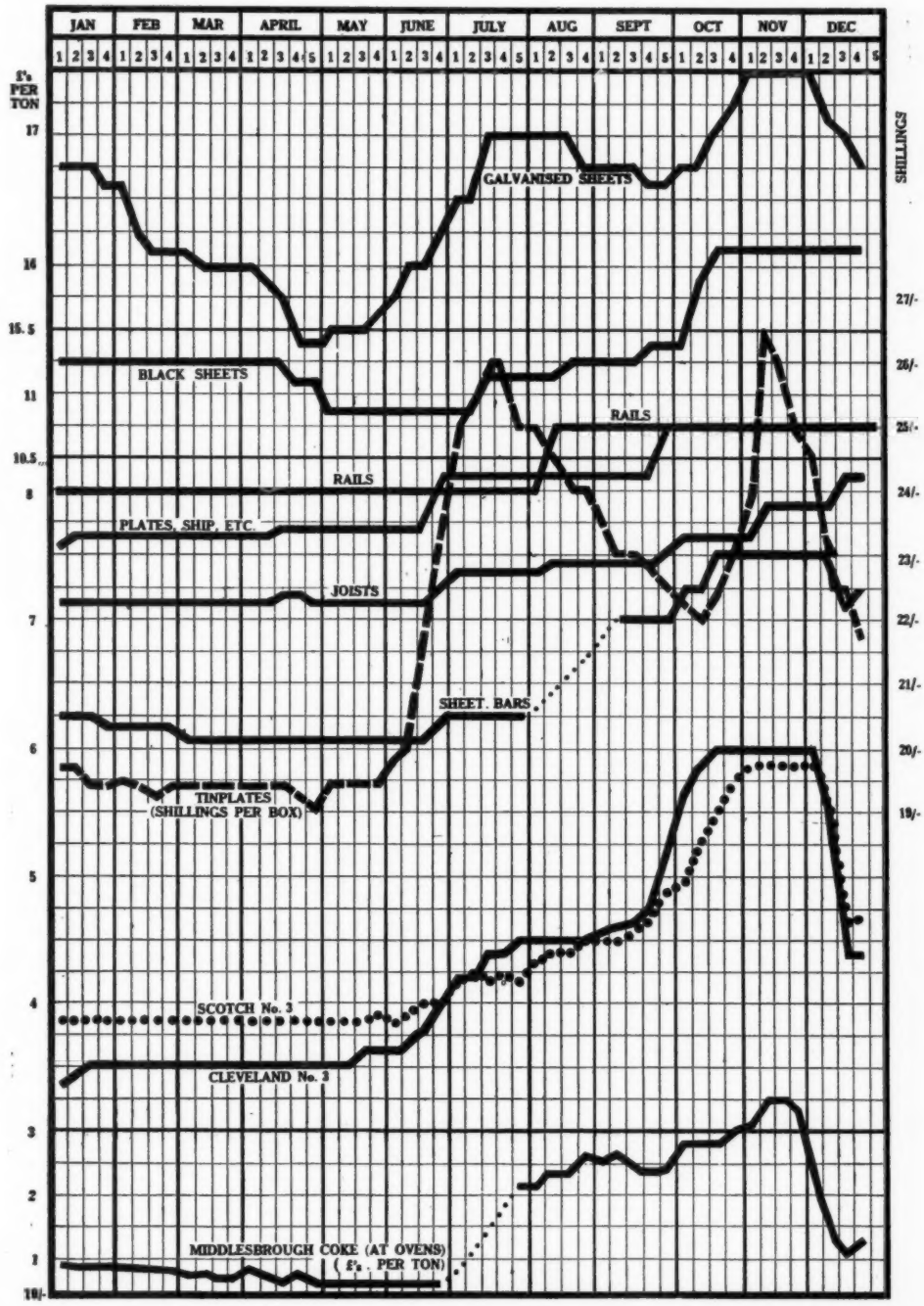
MR. KEY replied that he had no personal experience of hand machines, but he understood they were most useful, and good work was done on them. His experience of the electrical type was not very large, and he was not very favourably impressed with what he had seen. In his foundry green sand was never used except cold. They always made a special point of keeping the water down to a minimum, just sufficient moisture being aimed at to make the sand bind. It was largely to this fact that he attributed their successful results.

MR. G. NIELD, of Leeds, asked if in the case of small castings these could be turned out as cheaply by jolt ramming. His experience was that the time taken in moving the boxes for these light castings more than wiped out any apparent saving as between hand and machine jamming.

MR. A. S. WORCESTER stated that hand-jolting machines could now be obtained which were regulated by springs. These were very easy to work and could easily jolt up to half a ton.

MR. PARKER at this point had reluctantly to close the discussion, owing to the late hour. He would, however, like to say how much he appreciated the frank spirit in which MR. KEY had replied to all questions.

MR. H. SAYERS, of Leeds, moved the thanks of the meeting be tendered to MR. KEY. The lecture had been not only interesting but of high educational value. Personally he had no experience of jolt ramming, but his interest in the subject had been awakened, and he hoped their friend would be able to visit them again. MR. S. W. WISE (Secretary of the Branch) seconded, and MR. WORCESTER supported. The resolution was carried with applause, and MR. KEY suitably responded.



FLUCTUATIONS IN THE PRICES OF IRON AND STEEL PRODUCTS DURING 1926.

Some Notes on the Use of Bits.

BY J. E.

There have been many articles written on edge tools used by patternmakers, but very little has been said about boring bits, yet the brace is more used perhaps than any other tool in the patternmaker's kit. It is indeed in his hand almost every minute of the day, and the bits deserve as much attention as the paring chisel or gouge. Sharp bits result in better work, and especially is this true of auger bits, but they also save time and energy. It is surprising how some men will persevere with blunt and wrongly-sharpened shell bits, when a few minutes' work could make them much more efficient tools.

Boring bits may be divided broadly into three categories:—(1) Shell bits for boring screw holes; (2) centre bits for boring out recesses, also holes to be afterwards finished by gouges; and (3) auger bits for boring holes for dowels and rods, and indeed wherever accurate centring is necessary.

Sometimes a centre bit may be used for an auger-bit job, but it is seldom satisfactory to do so. Occasionally an auger bit will be used for boring out, but this is foolish as it considerably reduces the life of the bit, as the auger bit is an exceedingly delicate tool.

When boring for screws it is important that the right size of bit should be used, and that it should be neither too tight nor too slack. It is not uncommon for pattern-makers to use a No. 14 bit for a No. 12 screw, and this does not result in satisfactory work. It is equally unsatisfactory, however, to use a shell bit that is too small for the screw, as not only is there the possibility, especially with delicate work, of injuring the work, but it is almost impossible to take a screw out, if it is required to do so, at a future time. The shell bit ought to make a clean round hole, which the screw fits exactly. To save time, and especially is this fairly common when inserting small screws in the work, a hammer is frequently used to drive in the screw. The saving in time is more apparent than is real, and it is an extremely foolish practice.

Sharpening Shell Bits.

Considerable skill is necessary to sharpen a shell bit, so that the borings will be lifted out with the bit when withdrawn. As the patternmaker uses soft wood chiefly, the plain shell bit without the lip, and unpointed, is most suitable for this work. The sides of the bit should never be required to be touched with the file; some craftsmen file the cutting edge to a sharp point, but while the bit sharpened in this way bores quickly enough through the timber, it does not make as clean a hole nor do the borings come out as freely as when it is sharpened with what may be termed a "square end." A flat should then be filed across the back of the bit making a notched point.

A countersinking bit is not of great value to the patternmaker unless when a considerable number of screws have to be inserted in hard wood. It is a bad practice to drive screws so deep that the heads are concealed under the surface of the timber. When using hard wood, however, the sharp countersinking bit, carefully used, makes a cleaner and more satisfactory job than the countersinking gouge, apart from the fact that it is much cleaner.

With sharpened centre bits it should not be necessary to file the outside of the bit, if the cutting edges of the bit are not at equal distances from the centre, and the result is that a very rough hole is obtained. The centre bit should cut and not bore the timber, and the outside of the bit is left untouched. With regard to auger bits, the screws should never, under any circumstances, be touched, even if through carelessness they should touch a sunken screw, and the point of the bit is injured; it is better to leave it this way than to attempt to rectify it with the file. For auger bits, a very small smooth file should be used, and as in the case of the centre bits, the outer diameter of the bit should not be interfered with.

Many patternmakers who take the greatest possible care of chisels and gouges, throw all kinds of bits loosely into a drawer. It should be remembered that centre, shell and auger bits are all cutting tools, and should be treated as such. It is advisable to make specially hard cases for each auger bit, and to use a cloth or leather pad for the centre bits and shell bits. Only by taking special precautions can they be kept in good condition.

We read in a journal recently that it was advisable to mark on the shanks of all bits their sizes to sixteenths of an inch. An experienced craftsman can tell the size of any bit, however, by glancing at it.

Use of the Auger Bit.

Although metal dowels have come largely into use in recent years, for many purposes wood dowels are still preferred, and the auger bit is much more satisfactory for boring holes for such dowels than the centre bit. There are several ways of marking centres for holes to be bored accurately with screw bits; the use of pins is one way, the pins to be placed on one piece of wood, and when the other piece is located on it, it is given a sharp tap with the hammer, the impression of the head of the pin giving an accurate centre. Wherever possible, however, it is better to use try-square and marking gauge, used from planed edges, to mark the centres of holes to be bored, and even then it is advisable, when accurate work is demanded, that the centre should be pricked with a sharp nail, punch, or other pointed tool. The try-square should be used repeatedly, to test the squareness, both vertically and horizontally. Dowel pins are sometimes guided by means of a dowelling jig, which is put directly on to the work, but this is not often done in patternshops.

Boring with the Auger Bit.

When the spur of the bit comes through the timber, the boring should be stopped, the bit removed, the brace reversed, and the hole bored from the other side. This is only possible, of course, when the hole is to be bored right through the wood, and very often dowel holes are only bored certain distances into the work. Boring from the other side ensures clean edges, and in removing the bit, the brace should be given one turn backward to loosen the screw point, and then pulled out while turning steadily forward; this ensures bringing out the shaving.

Foundry Query.

Vein Marks in Ingot Moulds.

I should be glad if any of your readers could advise me the best method to overcome internal vein marks, in round, dry sand, tapered ingot moulds having an internal diameter of 12 to 13 in.; a length of 6 ft., and 3 in. thick. They are cast on end, with down runner 2 in. dia., and inlet cut at the bottom joint to follow the shape of the mould to give free access to the metal. The tackle used for the core is a tapered corebar of 8 in. to 6 in. dia., and 6 ft. 9 in. long. It contains 1-in. dia. vent holes 6 in. apart. Of these there are four rows. Straw rope, ½ in. dia., is wound around to give free escape for the gases. Core sand, consisting of ⅔ red, ⅓ black ordinary foundry sand, and a quantity of dried manure, is mixed and placed in a mill and ground for one minute. During the process of ramming the core, ½ in. dia. wrought iron welded rings, of a size sufficient to give a full inch of sand between ring and corebox, are placed about 9 in. apart, to assist the core to hold up against the vibration of rapping the iron corebox, while being drawn from the corer. This is finished and blacked with coke blacking, mixed with blue clay wash, and ground in a mill for nine hours.

The mould is rammed in an iron-framed boxpart, finished and blacked similar to core. Both are well dried in a stove for a period of 14 hours. —"ANXIOUS."

ROBERT THOMPSON & SONS, LIMITED, have booked an order for a 7,000-ton cargo steamer from Lord Glanely.

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Trade Talk.

THE MERCANTILE DRY DOCK COMPANY, LIMITED, Jarrow, have booked a contract for repairing the Greek steamer "Maria P. Xila," which is lying at Emden, Germany.

MESSRS. KEK, LIMITED, grinding specialists, of Aldwych House, London, W.C.2, report amongst recent orders for grinding and blending mills a No. 3 Kek Mill for Magnesite Works (Italy).

AFTER NEARLY EIGHT MONTHS enforced stoppage of operations caused by the national coal strike, two blast furnaces were blown in on December 27 by the Millom & Askam Hematite Iron Company, Limited.

THE ROYAL METAL TRADES PENSION AND BENEVOLENT SOCIETY'S annual dance will be held at the Hotel Cecil on Friday, January 21. Mr. F. Malcolm Garnham (J. B. Barnham & Sons) will be the chairman.

THE SENTINEL WAGON WORKS, LIMITED, Shrewsbury, are supplying their locomotives to the Great Southern Railways (Ireland), the Orki Division, P.W.D. India, and the Upper Chenab Canal Irrigation Works, India.

THE CROWN AGENTS FOR THE COLONIES have placed an order with Beyer, Peacock & Company, Limited, for three Garratt patent articulated locomotives of the 2-8-0 0-8-2 wheel arrangement, each weighing approximately 150 tons.

THE POWER GAS ECONOMY COMPANY, 50, Wellington Street, Glasgow, have sold, in the last six months, 55 gas burners, in France, for boiler firing. Most of these are large capacity gas burners of the latest Hunter types, which take all their air for combustion pre-heated, and under a small pressure.

PRESIDING AT THE ANNUAL MEETING of the Cleveland Bridge and Engineering Company, Limited, at Darlington, Mr. J. R. Dixon announced that new orders on which they were preparing to start included a floating landing stage for the Port of London Authority at Tilbury, to cost about £250,000; a new power station at Barking; a new power station at Coventry; and a large pipe line for North Wales. The value of these three latter contracts, he said, was about £220,000.

INTERNATIONAL COMBUSTION, LIMITED, of Africa House, Kingsway, W.C.2, inform us that their associated company in America have recently received orders for four complete Lopulco systems, two Raymond mills and one Impax mill, 59 boilers, 47 stokers, 10 air heaters and one oil still. The Australian Company are supplying the Broken Hill Proprietary Company with a complete Lopulco equipment for three Babcock & Wilcox boilers, including the necessary Raymond pulverisers.

THE CONSTRUCTIONAL ENGINEERING COMPANY, LIMITED, Titan Works, Charles Henry Street, Birmingham, have received orders from the Austin Motor Company (Birmingham), for a cupola, fan, etc.; R. W. Crosthwaite, Limited (Thornaby-on-Tees), for a cupola, fan and motor, sand dryer, etc.; Henry Hoole & Sons (Sheffield), for a complete melting equipment (third repeat order); Court Works, Limited (Madeley), for a cupola, etc.; Willey & Company (Exeter), for a cupola, etc.; Derwent Foundry Company (Derby), for a cupola, etc.

HERNE BAY WATERWORKS have placed with Worthington Simpson, Limited, a contract for the supply of one 7-in. four-stage vertical borehole centrifugal pump driven through helical bevel gearing by a two-cylinder oil engine for their Ford pumping station. The capacity of the pump will be 650,000 gallons per day, delivering against a total head of 310 feet. Worthington Simpson, Limited, have also secured the contract to supply the complete surface condensing plant required for the power extensions of the Leicestershire and Warwickshire Electric Power Company's Spondon power station. The plant includes a 15,000 sq. ft. surface condenser, with steam jet air ejectors, pumps, motors and heater for 12,500-kw. Turbo-alternator plant. This will be the fourth plant supplied by Worthington Simpson, Limited, to this company.

AN ORDER for gas-producing plant, including Chapman gas machines and agitators, has recently been placed with Stein & Atkinson, Limited, 47, Victoria Street, S.W.1. This order is interesting in that the works for which this plant is intended have had similar producers for over six years. The agitators, which form a separate part of the order, are for fitting to existing Kerpeley producers, which will work in batteries with the Chapman gas machines. The combination of the Chapman agitator and the Kerpeley producer is not new in this country, there being a large number of steelworks in this country where such producers have been working several years. The plant on order consists of four gas machines and two agitators, to be fitted to the producers, and will be installed in two batteries, each of two gas machines and one producer, together with two producer buildings with coal elevators and conveyors, ash elevators and two railway wagon tipplers.

JAMES AUSTIN & SONS (DEWSBURY), LIMITED, iron and steel merchants and stockholders, Dewsbury, in order to cope with increasing business, find it necessary to provide larger accommodation, and have purchased the Thornhill Forge estate, where they will erect new and modern buildings suitable for their business. Thornhill Forge was closed down in July, 1924, when about 150 men were thrown out of employment. The firm of James Austin & Sons was established by the late Mr. James Austin in 1850 in quite a small way in a warehouse erected by him on the site now occupied by the Dewsbury covered market. With the assistance of his sons, Alfred, Cyrus and Harry, the trade was built up and extended very considerably. After the death of his father and two brothers, Mr. Harry Austin carried on the business alone, and it was he who built the large and commodious premises now occupied by the firm, and he turned the concern into a private limited liability company. Since the death of Mr. Austin in 1903, the company has been carried on by the present managing officials, and by them very considerably extended.

Patent Specifications.

The following list of patent specifications accepted have been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full specification can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

20,688. CROAD, A. K. (SAND SPUN PATENTS CORPORATION). Method of and apparatus for centrifugally casting hollow metal bodies. August 18, 1925. 261,112.

20,689. CROAD, A. K. (SAND SPUN PATENTS CORPORATION). Method of centrifugally casting hollow metal bodies, and hollow bodies cast by such method. August 18, 1925. 261,113.

21,456. HAWKINS, C. Furnaces. August 27, 1925. 261,126.

27,003. SIEMENS-SCHUCKERTWERKE GES. Electric resistance furnaces for bright annealing. December 15, 1924. 244,425.

29,005. WUST, F. Reverberatory furnaces. November 27, 1924. 243,711.

11,345. SOC. ANON. METALLURGIQUE D'AUBRIVES ET VILLERUPT. Metallurgical apparatus. April 3, 1926. 261,269.

22,522. CROAD, A. K. (SAND SPUN PATENTS CORPORATION). Apparatus for centrifugally casting hollow metal bodies. August 18, 1925. (Divided Application on 261,112.) 261,324.

18,314. BLESSING, E. F. Processes for the production of wrought-iron. July 17, 1925. 261,449.

20,824. BERRY & COMPANY, LIMITED, H., and BULL, G. Extruding-presses for forming rods and tubes from metal billets. August 19, 1925. Addition to 228,325. 261,474.

26,015. MICHEL, G. Treatment of magnesium or its alloys to be utilised for casting. October 17, 1925. 261,528.

19,334. KRONENBERG, R. Rolling-mills. August 4, 1926. 261,665.

14,232. SUFFERN, E. S. Method of and means for burning powdered or liquid fuel in furnaces. (May 29, 1925.) 261,807.

16,338. ELLIS, G. B. (Murray, T. E.). Protection of ferrous metals against corrosion. (June 24, 1925.) 261,809.

18,313. BLESSING, E. F. Puddling-furnaces. (July 17, 1925.) 261,812.

19,260. TOOTH, L. F. Metal-melting furnaces. (July 29, 1925.) 261,819.

8,244. CRAWFORD, A., AND CRAWFORD, J. Process for treating blast-furnace slag. (March 26, 1926.) 261,976.

14,390. BASSET, L. P. Process for the manufacture of metals or alloys in a revolving furnace. June 2, 1924. 234,853.

15,583. GIBARU, C. TOTOT-. Enamelling of cast and sheet metal. June 16, 1925. 262,159.

19,963. WHITTAKER, W. Furnace grates. May 10, 1926. 262,165.

23,818. HAMILTON, W. B., and EVANS, T. A. Alloy irons and steels and the production thereof. September 24, 1925. 262,206.

32,055. VERVOORT, J., and VERVOORT, B. Fire-bars for furnace grates. December 18, 1925. 262,277.

1,387. S.I.P. SOC. ITALIANA POTASSA. Method of separating aluminium nitrate from potassium, sodium, iron, calcium, magnesium nitrates, present in mixed solutions of these salts. January 28, 1925. 246,827.

2,102. MURAKAMI, Y. Manufacturing process of and means for rolling metal directly from molten metal without using ingot moulds. January 25, 1926. 262,291.

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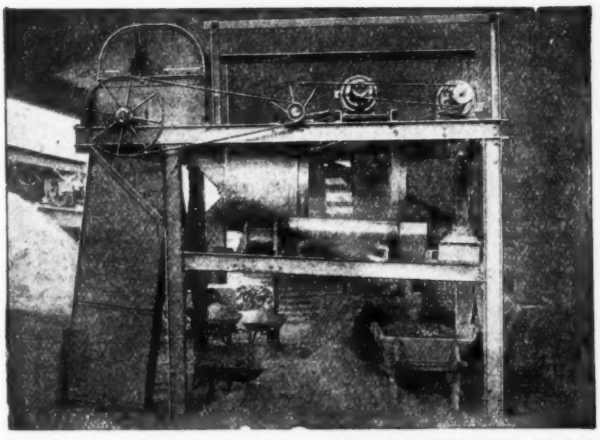

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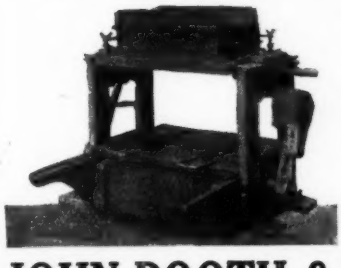

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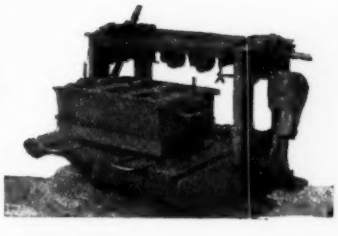

Patentees and Makers:

JOHN BOOTH & SONS, *General Ironfounders,* RIPPONDEN, nr. HALIFAX.

IRON AND STEEL MARKETS.

Pig-Iron.

MIDDLESBROUGH. — The re-opening of the Cleveland iron market after the holiday recess disclosed more animation in iron-trade circles than has been observable for many months past, while throughout a quiet confident feeling with regard to future business prospects was marked as the predominant note of an unusually numerous attendance. The recovery of the iron and steel industries on the North-East Coast has indeed been gratifyingly rapid, and by the end of the month it would not be at all surprising to find the number of blast furnaces in operation equal to that immediately before the strike. The number of furnaces already in blast is 26, two more having been relighted last week. The North-Eastern Steelworks of Messrs. Dorman, Long & Company have also partially resumed, after having been closed down for nearly three years.

Developments in the hematite section are also making steady progress on the North-East coast, Messrs. Gjers, Mills & Company, Limited, having re-started their works at Middlesbrough, and there should shortly be fair quantities of saleable hematite on the market. The quotation for East Coast mixed numbers for the first quarter is 90s. per ton. In the North-West area there are eight furnaces in blast, and it is hoped to light an additional two shortly. Two are in operation at Barrow and two at Millom; two at Derwent at Workington, and Cleator Moor had two working at the week-end.

LANCASHIRE.—Business in the local markets for foundry pig has as yet hardly recovered from the holiday influences, and there is not a great deal of inquiry about. Quite a substantial addition to the blast furnaces in operation in the Midland counties is looked for in the near future, and, whilst one or two firms are fully booked for January delivery, it is still possible to place orders at 92s. 6d. at the furnaces, or round 100s. per ton delivered here, whilst from 5s. to 7s. 6d. per ton less than this is being asked for delivery in the following month.

THE MIDLANDS.—Pig-iron markets in this district are awaiting further developments, only a limited amount of Derbyshire No. 3 being available for January at 92s. 6d. f.o.t. furnaces, but other Derbyshire No. 3 iron is offered at 85s. f.o.t. for delivery when the furnaces resume. Northants No. 3 pig is quoted at 82s. 6d. and up, f.o.t., and some iron is offered for January. Lincolnshire No. 3 iron is quoted at £5 2s. 6d. to £5 5s., delivered.

SCOTLAND.—On Clydeside there is very little demand for pig-iron, and whilst there are about half-a-dozen furnaces now in blast, and some hematite has been made, no foundry of No. 3 quality has yet been produced. The price of No. 3 Scotch foundry runs from 90s. to 95s. at the furnaces, the lower prices being quoted by makers not yet restarted, but consumers are not taking much interest.

Scrap.

Much more active conditions may now be noted in markets for scrap metal than has been the case for some time past, but as supplies are fairly plentiful, little change in prices is expected at present. In Scotland, machinery cast-iron scrap suitable for foundries, and in pieces not exceeding 1 cwt., is still a little easy, and some good lots have been offered around £3s. 6d. to 85s. per ton, but little business has been done. Good clean, heavy, ordinary cast-iron scrap to the same specification is 5s. per ton less, and for steelworks cast-iron, in furnace sizes, 72s. 6d. to 75s. per ton. Old cast-iron railway chairs are 82s. 6d to 83s. 6d. per ton. Light cast-iron scrap has been done again this week around 61s. 6d. to 62s. 6d. per ton. The above prices are all per ton delivered, f.o.t. consumers' works.

Metals.

Copper.—With consumptive demand in slightly decreased volume, usually observable at this period of the year, values of standard cash copper have developed a somewhat weaker tendency, though fluctuations in this direction are by no means of important significance. The metal has, however, shown some resistance to the present level, which is considered relatively low, while in the event of a revival of activity in the new year, the market is not unlikely to become sensitive.

Official closing prices of standard copper have been as follow:—

Cash: Thursday, £56 5s. to £56 7s. 6d.; Friday, £56 2s. 6d. to £56 5s.; Monday, £56 to £56 2s. 6d.; Tuesday, £55 17s. 6d. to £56; Wednesday, £55 10s. to £55 12s. 6d.

Three Months: Thursday, £57 2s. 6d. to £57 5s.; Friday, £57 to £57 2s. 6d.; Monday, £56 17s. 6d. to £57; Tuesday, £56 12s. 6d. to £56 15s.; Wednesday, £56 5s. to £56 7s. 6d.

Tin.—After dropping for a time below the £300 level, the position of standard tin has again returned to more stable levels, although the effect of the December statistics may have an adverse influence later. For the present the market for near tin is comparatively easy, while the premium thereon has been reduced from about £9 to £4 per ton, and it is possible that the margin may be reduced a little further, due to the expectation of further quantities going into stock. There has been some weakness in the Eastern markets, with a sharp and sudden drop in prices.

Official closing prices of standard tin have been as under:—

Cash: Thursday, £301 10s. to £301 15s.; Friday, £300 5s. to £300 10s.; Monday, £303 to £303 5s.; Tuesday, £301 to £301 10s.; Wednesday, £299 10s. to £299 15s.

Three Months: Thursday, £296 5s. to £296 10s.; Friday, £294 12s. 6d. to £294 17s. 6d.; Monday, £297 to £297 5s.; Tuesday, £295 to £295 5s.; Wednesday, £294 10s. to £294 15s.

Spelter.—A trade circular states:—The demand from galvanisers which arose recently developed somewhat, but, influenced by the holiday, has not been carried further, and the market, although firm, has not been stimulated into very much activity. A demand for December shipment has caused a sudden shortage.

The following are the week's prices:—

Ordinary: Thursday, £32 15s.; Friday, £32 15s.; Monday, £32 15s.; Tuesday, £32 7s. 6d.; Wednesday, £32.

Lead.—A recent slight revival of consumptive demand for soft foreign pig has had a steadying effect upon markets, and the position seems healthy enough, although there is a good surplus carried by dealers in this market. Sales of lead products, it is understood, have improved considerably, and manufacturers have covered orders to a considerable extent. Continental demand is still, however, very slack, and lead is reported to be offering at below the London parity.

The week's prices are appended:—

Soft foreign (prompt): Thursday, £28 18s. 9d.; Friday, £28 16s. 3d.; Monday, £28 12s. 6d.; Tuesday, £28 10s.; Wednesday, £27 17s. 6d.

Foundry Query.

Tapping Hole Sand Mixtures.

In the course of Mr. Cooper's lecture before the Junior Section of the London Branch of the Institute of British Foundrymen on "Moulding Sands" the question of the nature of sands was raised. He mentioned that the bond of sand was determined by the size of silica grains, and also the percentage of clay contained therein. I should like to know whether a bond given by 40 per cent. Mansfield Red sand, 40 per cent. fireclay, and 20 per cent. pure oil sand would make a suitable tapping-hole mixture. I have witnessed tapping holes being blown away under blast, and the reason given for this was inferior products. The ordinary mixture of Mansfield Red sand and fireclay can stand up to furnace blast, but in the case of inferior sands, the oil-sand might harden the mixture to such an extent as to withstand the maximum furnace blast. I should very much like to have Mr. Cooper's views, and also any other furnacemen who have experienced similar trouble.—J. P. M.

[The frictional resistance of the plug is naturally governed by the area of the hole, and the composition of the sand and clay forming the plug may be immaterial.—EDITOR.]